

Papers presented at the

**EXPERT CONSULTATION ON ECONOMIC INCENTIVES
AND RESPONSIBLE FISHERIES**

Rome, 28 November-1 December 2000



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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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PREPARATION OF THIS DOCUMENT

This document contains the papers submitted by the FAO Secretariat and resource persons to the Expert Consultation on Economic Incentives and Responsible Fisheries, held in Rome, Italy, from 28 November to 1 December 2000. Except for the document submitted by the FAO Secretariat, the views expressed in these papers are those of the author(s) and should not be attributed to FAO.

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ABSTRACT

This report contains five documents used during the Expert Consultation on Economic Incentives and Responsible Fisheries, held in Rome, Italy, from 28 November to 1 December 2000. One of the five is a document prepared by the FAO Secretariat. It provides guidelines for the discussion during the Consultation. The other four documents were prepared by resource persons. One of these contains a thorough and exhaustive review of the concepts that have been used to define fishery subsidies. Another of the reports contains a review of the published assessment of the public sector subsidies to the fishery sector and their effect on fishery resource sustainability. The remaining two reports deal with fishery subsidies and trade. One reviews methodologies used by various parties in international disputes about the trade-distorting impact of subsidies to specific sub-sectors in the fishery sector. The last report reviews in general terms the impact of subsidies to the fishery sector on trade of fish and fish products.

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PAPER PRESENTED BY THE FAO SECRETARIAT

SUBSIDIES AND THE FISHERIES SECTOR; FACILITATING THE INTERNATIONAL DISCUSSION

1. PURPOSE

The paper is addressed to the participants in the *Expert Consultation on Economic Incentives and Responsible Fisheries*. The paper aims to give the background to the Expert Consultation and to briefly present the main issues to be discussed by the experts.

2. SUBSIDIES TO THE FISHERIES SECTOR; A BRIEF REVIEW OF THE INTERNATIONAL DISCUSSION

After reviewing subsidies in the agricultural sector during the 1980's the OECD attempted to do the same in the fisheries sector. The effort did not yield the expected results.

The international fisheries community resumed its interest in subsidies about ten years ago, when FAO published¹ information from which it could be concluded that subsidies to the fisheries sector were huge. The debate that followed involved many different participants reflecting a broad range of interests: governments, fisher organizations, and representatives of civil society, economists and other fishery scientists.

The debate that has taken place on two levels: a "policy" level and a "technical" or social science dominated level. Representatives of the different groups of participants have participated in both debates. In fact these debates have been conducted simultaneously – the one influencing the other.

2.1 The policy discussion

The discussion has taken place mainly in fora such as APEC, the WTO (Commission on Trade and Environment), OECD and, to a lesser extent, in FAO. It has also been brought up for consideration in meetings organized by groups such as the WWF.

Initially government representatives were most concerned with trade distortion and, they argued their case against subsidies referring to macro-economic policies. It was mainly those from academia who pointed out that subsidies, by stimulating effort, also could negatively affect living aquatic resources. This argument became part of the more general debate on trade and environment. Representatives of civil society have been concerned predominantly about the preservation and conservation of aquatic species. As is natural, representatives of fishers have expressed views reflecting their direct interest in the industry.

The various thesis proposals/purposes that have dominated the policy discussion so far can be summarized as follows:

- affirming the view that subsidies are bad for the sustainability of wild aquatic resources and the cause of excess fishing capacity;
- affirming the view that subsidies are trade distorting;
- affirming the view that subsidies are no more than one of the many factors that could cause unsustainability of wild aquatic resources and excess fishing capacity;
- affirming the view that subsidies could contribute to the preservation of social, anthropologic and environmental values; and,
- generating consensus that more analysis should be undertaken on the effects of fishery subsidies thereby providing a base for the control, reduction or banning of certain subsidies.

The discussion has progressed slowly. At the beginning of 2000 it would seem fair to say that there is a consensus that:

¹ SOFA 1992. Special chapter

- the annual volume of subsidies to the sector are not as large now as they may have been at the beginning of the 1990s
- subsidies are not uniform in their effects;
- effects can be positive or negative;
- the effects of any one subsidy will depend on the circumstances in which it is used;
- it may be useful to recognize that there are several categories of subsidies; and,
- it is unlikely that there will be a general consensus on eliminating all types of subsidies in all situations.

Also there seems to be a tacit understanding that progress will be slow until more facts are provided. In particular more accurate information is needed on the magnitude of the impact of fishery subsidies on trade and on resources sustainability. This seems reasonable. The parties are unlikely to agree on a common approach to subsidies until they have such information.

A first step is to identify reliable methodologies for measuring such impacts for the various categories of subsidies. In fact the choice of categories should possibly take into account the methodologies that can be developed for measuring impact.

Once categories and methodologies have been identified there should also be some agreement on which categories of subsidies it is most urgent to study.

These are all issues that will benefit from being reviewed in technical discussions.

2.2 The technical discussion

The technical discussion has been much more low-key. It has focused on:

- what is and what is not a fisheries subsidy;
- what are the impacts of fishery subsidies on trade
- what are the impacts of fishery subsidies on wild aquatic resources

The discussion has been conducted more in academic environments and technical journals than in public policy fora.

The definition of subsidies in fisheries. So far the discussion has not led to a commonly agreed definition of subsidies even amongst the economists and fishery scientists involved.

There is an urgent need to find a definition of the subsidy concept that meets three tests. *First.* It should be applicable to all those various forms of interventions by the public sector in favor of the fishery/aquaculture sector and are susceptible to being labeled as subsidies. *Second.* It should also have a high likelihood of being accepted by those who are involved in the political debate about fishery subsidies. *Third.* It should be designed in such a fashion that it be possible to measure effects of subsidies on trade and resources.

The effects of subsidies on trade of fish and fish products. Most economists and other scientists that have considered this issue agree that subsidies affect trade. The magnitude of the effects has not been studied.

Cost-effective, agreed, methodologies for measuring the impact of subsidies on trade are needed. These methodologies need to be adapted to the various categories of subsidies.

The effects of subsidies on fishery resources sustainability. Investigations of the effects on fishery resources have not come very far. There are no studies that provide well documented, quantitative information about the effects of subsidies on wild aquatic resources. Effects remain conjectural.

Nevertheless there is agreement amongst knowledgeable observers, that subsidies, by stimulating fishing effort, can constitute a threat to wild aquatic resources. Simultaneously many economists and fishery scientists agree that in those situations where management is effective and stocks are healthy, subsidies to the

particular fishery do not have adverse effects on resources. Effective management in this context translates as the ability to effectively limit effort. To say that subsidies have no effect is the same as saying that the effect of subsidies is a function of the effectiveness of management. However, in this context some parties point out that while this is true, so far effective fisheries management is the exception rather than the rule.

Also in respect of effects on resources there is a need to develop cost-effective methods of establishing the consequences of subsidies.

2.3 Conclusion

The international political debate about subsidies to the fisheries sector is likely to progress when there is an agreement on exactly how subsidies impact the sector, both positively and negatively. Thus the next step in the technical discussion/investigations could usefully aim to:

- arrive at a consensus definition of subsidies and how to categorize them;
- rank the categories according to the possible magnitude of effects;
- identify methods to measure the effects of subsidies on trade and resources, by category of subsidy; and,
- estimate the cost of applying these methods

3. ISSUES TO BE CONSIDERED IN THE EXPERT CONSULTATION

A number of issues – framed as questions - will be examined by the Expert Consultation. These issues have been selected because it is believed that their resolution by technical experts will be of use in the ongoing policy discussion.

But, the Expert Consultation has no means to force its solutions on the policy makers. The solutions must therefore be such that they have likelihood to be accepted by the various participants in the policy discussion. Preferably solutions should be shown to be sound, practical and economically feasible and presented in a non-technical language.

It seems plausible – because of lack of time and/or information - that the Expert Consultation will not find answers to all the issues described below. When a solution, or answer, cannot be found, the Consultation is expected to identify the activities that it considers must be carried out in order to find the answers/solutions.

3.1 The search for an operational definition of subsidies

Before considering the text of the definition, it would probably be useful to agree on what characteristics need to attach to the definition. Those characteristics depend upon the future analytical work to be done in respect of subsidies and their effects on the fisheries sector. It is suggested that the essential characteristics for the definition be:

- that it remove the pejorative connotation associated with the term “subsidy”
- that it permit the volume of subsidies to be measured
- that it be flexible enough to include the incorporation of new economic policy instruments; and,
- that it be consistent with subsidies as presently understood in international agreements that deal with subsidies.

When considering the precise text of a definition it is suggested that the Expert Consultation consider first the definition proposed by Schrank. It reads as follows:

Subsidies should be broadly defined as any government actions that are anticipated to affect the profits of the firm in the short-, medium-, or long-term.

3.2 Which are the most appropriate, operational categories of subsidies?

The reason to break down subsidies into categories is that this will facilitate the analysis needed to establish the impact – positive or negative – of subsidies. The Expert Consultation is asked to confront this question because the assembled experts are expected to have a view on which types of categories are important (and those are the ones on which future work is likely to be concentrated) and also have an appreciation of the processes through which various types of subsidies influence trade and/or the status of living aquatic resources. For analytical purposes it would seem reasonable to group together those subsidies that have similar mechanisms or procedures for influencing trade and/or living aquatic resources.

Also in this instance it would seem useful for the Expert Consultation to take Schrank's list of categories of subsidies as a starting point for the discussions. The categories are:

- a. *direct government payments to, or on behalf of, the industry;*
- b. *tax waivers and deferrals;*
- c. *government fishery loans; loan guarantees and insurance;*
- d. *implicit payments to, or charges against, the fishing industry;*
- e. *general programs that affect fisheries;*

Schrank provides (FI:EIRF/2000/Inf.3; pages 31 to 33) a large number of examples under these categories.

It is proposed that the first issues to be considered in the Expert Consultation be: Are the five categories adequate? Should there be fewer or more? Will it be useful to break down the categories further?

3.3 How do we best measure the volume of subsidies?

The experts under this agenda item are asked to agree on the most adequate unit of measurement to use when estimating the volume of subsidies provided to the sector over a particular period. The method of measurement should be specified for each category of subsidies.

3.4 How do we best measure the impacts of subsidies on trade in fish?

This question essentially breaks down into four tasks.

First. Agree on a qualitative description of the process through which trade is influenced by subsidies. Such a description should be made for each of the subsidy categories.

Second. Identify ways of measuring the magnitude of the impact.

Third. Identify those categories (or single types) of subsidies that are likely to have the most pronounced effects on trade.

Fourth. Assess the resources needed to apply the methods of measurement.

3.5 How do we best measure the impacts of subsidies on living aquatic resources?

Also this question breaks down into four tasks.

First. Agree on a qualitative description of the process through which the status of living aquatic resources is influenced by subsidies. Such a description should be made for each of the subsidy categories.

Second. Identify ways of measuring the magnitude of the impact.

Third. Identify those categories (or single types) of subsidies that are likely to have the most pronounced effects on living aquatic resources.

Fourth. Assess the resources needed to apply the methods of measurement.

3.6 What are the next steps in resolving technical issues linked to the assessment of the role of subsidies in fisheries?

This question in effect will be repeated under each of the above agenda items, in the case that the Consultation does not arrive at a complete response to the questions raised.

PAPERS PRESENTED BY RESOURCE PERSONS

SUBSIDIES FOR FISHERIES: A REVIEW OF CONCEPTS

by

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"My own starting point was also an attempt to define subsidies. But in the course of doing so, I came to the conclusion that the concept of a subsidy is just too elusive"

Hendrik S. Houthakker
Harvard University (JEC, 1972, 7)

EXECUTIVE SUMMARY

Despite the fact that "subsidy" is a common word in everyday language and despite the fact that subsidies are endemic in fisheries, the word is somewhat less than useful for analytical purposes in the management of fisheries because the word means different things to different people. Views of subsidies are determined as much by self interest, politics, goals concerning the fishery and social perspectives as by any objective criteria. Although fisheries subsidies have existed for a very long time, it is only over the past decade that fisheries subsidies been subject to much scrutiny. They are under increasing scrutiny primarily because of the recognition that many of the world's commercial fish stocks are endangered, and that the existence of certain subsidies encourages the overcapacity and overfishing that is endangering the stocks. The discussion of subsidies must therefore be placed in context. The relevant context, presented in Section II, is set by the concatenation of four factors: the expansion of world fishery harvests since 1950, the expansion of national jurisdiction over fisheries in the mid-1970s, our present inability to accurately predict fish populations, and our failure to systematically monitor the economic state of fisheries.

The range of opinion about what subsidies are is enormous. A general survey of concepts of subsidies is presented in Section III, while Section IV presents a survey of the literature of fisheries subsidies. Some people would restrict the concept of subsidies to government expenditures, or to any actions that affect government finance, or to a range of government actions that do not necessarily affect government finance at all. Some would limit discussion of subsidies to activities that impinge on international trade, others would expand the concept to concerns with domestic, as well as international, markets. Some would limit the concept of subsidies to government policies that have negative economic effects, while others would not. Some would limit the term to government policies that only affect a single industry or group of industries, while others would place no such restriction. Some would rely heavily on the intentions of the government in adopting a subsidy; others consider such subjective considerations to be irrelevant. A few would banish the word entirely.

Since the question of the utility of subsidies plays an important role in the analysis of government policy, the amorphous nature of the term "subsidy" leads to conflicts over what is meant by the word. These conflicts, in turn, distract from the more useful questions of what role a certain government action plays in the economy and whether or not this role, in each specific case, is desirable. The purpose of this paper is to provide an operational framework for dealing with fisheries subsidies, a framework that will prove useful to those who have to deal with the issue of subsidies at the government level.

This paper, in Section V, argues for a broad definition of subsidies. Such an approach has the effect of enveloping the myriad of concepts that appears in the literature, and provides a framework which avoids the value connotation that often confuses and impedes analysis. In short, the conclusion of the paper is that subsidies should be broadly defined as any government actions that are anticipated to affect the profits of a firm in the short-, medium-, or long-term. Subsidies can then be positive (increasing profits) or negative (decreasing profits). They can affect international trade or be strictly domestic. They can be good or bad, constructive or destructive. They may have the intended effect of a government action, or different effects. They can increase or decrease government revenues, or they can have no effect on government revenues. With a broad definition, the focus of discussion can shift to the analysis of the effects of the subsidy, and the analyst, policy maker, or public can then judge the effects of the subsidy and determine whether the subsidy should be maintained, increased, decreased, or eliminated entirely.

Section VI closes the paper with a consideration of the problems that might be encountered in trying to reach a consensus on the meaning of the word subsidies and on whether particular subsidies are desirable or not. Since views of subsidies are largely determined by the subjective judgements and goals of individuals, differences of opinion will always exist. Progress in the ability to accurately forecast fish populations and in developing a more inclusive analysis of the economic state of fisheries would help to eliminate differences that rest on factual bases. As long as the interpretation of facts is unclear, consensus on appropriate actions regarding subsidies will be difficult or impossible to obtain. Even without disagreement on facts, subjective considerations based on alternative objectives and goals will lead different parties to different conclusions concerning what actions should be taken. Nonetheless, the operational approach to subsidies taken in this paper should provide a framework for facilitating useful discussions of fisheries subsidies.

I. INTRODUCTION

Fisheries subsidies are endemic, playing a major role in many of the fisheries of the world. Yet the concept of subsidies is a slippery one with many divergent opinions as to what constitutes a subsidy. Views of subsidies are determined as much by self interest, politics, goals concerning the fishery and social perspectives as by any objective criteria. While fisheries subsidies have existed for a very long time, it is only in the past decade that they have, in themselves, been subject to much scrutiny. Our starting point, in Section II, is to present a brief historical overview of the state of fisheries, fisheries science, and fisheries economics in order to provide a context for the current concern with subsidies. The overview focuses on the concatenation of four factors: the expansion of world fishery harvests since 1950, the expansion of national jurisdiction over fisheries in the mid-1970s, our inability accurately to predict fish populations, and our failure to monitor the economic state of fisheries.

In Section III we present a survey of concepts of subsidies, and in Section IV we continue the survey, but with a focus on fishery subsidies. What is clear from these surveys is that different authors mean very different things when they refer to subsidies. Since the question of the utility of subsidies plays an important role in the analysis of government policy, the amorphous nature of the term "subsidy" leads to conflicts over what is meant by the word. These conflicts, in turn, distract from the more useful questions of what role a certain government action plays in the economy and whether or not this role, in each specific case, is desirable. Discussions of the role of subsidies tend to fuzziness because participants are often meaning different things when they use the word. As we shall see, occasionally the word subsidy is banished entirely.

In Section V, we synthesize the discussion of concepts and propose an approach to subsidies intended to be operational, useful to those who deal with subsidies in the development of government policy. The proposal removes any value connotation from the term "subsidies," for the purpose of laying the groundwork for a more objective, value-neutral approach to government economic policies in fisheries. The paper closes with a discussion of the search for consensus and consideration of the question of whether agreement on the definition of subsidies is possible.

In short, the goal of this paper is to synthesize selected portions of the literature on subsidies, to draw conclusions suggesting how subsidies can be viewed most usefully, and to suggest actions necessary in the international sphere to encourage acceptance of a standard concept of subsidies.

II. BACKGROUND

The last half of the twentieth century saw an enormous increase in marine fish harvesting. From 1950 to 1990, the reported world catch of marine fish and shellfish rose fourfold, from 17 million metric tons (Mmt) to 85 Mmt (FAO, FISHSTAT). Among the many causes were improved technology (FAO, 1992, 4); increasing demand (Montfort, 1994; Westlund, 1995); and the decision in the Soviet Union to replace meat with fish for animal protein (Mikhailov, 1962, cited in FAO, 1992, 11).

Shortly after the start of this period of expansion, the first English language economic explanation of the tendency of open-access fisheries to deplete fish stocks appeared (Gordon, 1954). In the following year, Scott (1955) offered the suggestion that the solution to the problem described by Gordon lay in the privatization of the fishery commons. While much progress has been made during the ensuing half century in our understanding of the economics of fisheries, there has been a gaping failure in a rather mundane area: there has been little sustained economic analysis of the viability of the world's fisheries. A significant cause has been the absence of suitable data. The FAO is the international coordinator and publisher of fishery statistics, yet the emphasis for the harvesting sector has been on the gathering and publishing of landings statistics in volume terms. In this area the FAO has done a superb job, with continuous series now existing from 1950 to the present. But, despite the occasional pleas of economists (A.D. Scott in FAO, 1962, 22-31; Schrank, Hannesson and Pontecorvo, 1995), the FAO has been hesitant to enter the arena of economic statistics in the harvesting sector. The reasons are many. The FAO does not gather its statistics itself, but relies on the cooperation of the countries of the world to supply the numbers. Adding catch revenue and cost data to the FAO database would require that the individual countries gather these data. The usual response to the suggestion that they gather such data is that the cost would be prohibitive. A further reason for the reluctance of countries to gather economic data is that such figures are often considered to be industrial secrets. Moreover, the release of such data might show that the industry is being subsidized, opening the industry to countervailing duty attacks from its fish product trading partners. The FAO diplomatically notes that "fisheries cost and price information is not a high priority for most States, at present, largely because the value of such information is not readily evident to administrators (FAO, 1992, 18)."

Fisheries biology in aid of the fishing industry has a much longer history than does the economic analysis. In a study of the history of fisheries science to 1955, Smith (1994) dated the origin of sustained research in direct aid of the fishing industry to an 1864 decision of the Norwegian government to hire Georg Sars to investigate the reasons for fluctuations in the Lofoten cod fishery. Smith emphasized, however, that while much progress in fisheries biology had been made, up to a half century ago it remained virtually impossible to predict future fish populations. Prediction of recruitment today, fifty years later, still appears to be largely beyond the capability of science. While much progress has been made in both the economic and biological modeling of fisheries, certain critical empirical realities of the biology and economics of fisheries remain elusive.

Besides the growth of fishery production, our inability accurately to predict recruitment, and the lack of economic monitoring, there is a fourth crucial characteristic of the world's marine fisheries. The mid-1970s saw a major change in the law of the sea, with coastal states extending their jurisdiction over fisheries.¹ Most fishing occurred within the new coastal zones² so the anticipated results were that foreign distant water fleets would be displaced, domestic catches would rise, international trade in fish products would increase dramatically, and the coastal states would manage their fishery resources for sustainability (Robinson, 1980). The first three anticipations were realized.³

¹By September 1, 1977, 68 coastal states had extended their fisheries control zone beyond 12 miles, 51 of them to 200 nautical miles from shore (Eckert, 1979, 129).

²Eckert (1979, 116) states that 90% of the world's catch was taken within 200 miles of shore.

³For the increase in international trade, see FAO (1992, 29); for the decline in the activities of distant water fleets, see FAO (1999, 7).

At the time of the adoption of the 200 mile fisheries control zones, for instance, such coastal states as the United States and Canada adopted nationalistic policies whereby domestic fleets replaced the distant water fleets of foreign nations. The overriding national policies were concerned with domestic fisheries development presumably within a conservation framework.¹ Policies were invoked to aid in this substitution process. Among the mechanisms adopted were subsidies to encourage the desired development of the domestic fishery. In Canada, for instance, there were government sponsored loans for the building of small fishing boats, grants for boat building and grants for the building or expansion of fish processing plants (Crowley *et al.*, 1993). In the United States, there were tax shelters to protect current income of fishermen and fishing vessel owners from taxation while encouraging future fleet expansion or replacement (the Capital Construction Fund) and loans on favorable terms (the Financial Obligation Guarantee program).² This is not to suggest that all of these policies were adopted only at this time, or even only for the fishery, but that these subsidies were used for the economic development of the domestic fisheries. The sustainability of the fish stocks was merely assumed.

But this was a poor assumption and the fourth expectation from the expansion of fisheries jurisdiction, that fish stocks would be sustained through improved management, was not achieved. Were the expected sustainability results achieved, catches of the traditional commercial species would have stabilized, subject only to natural fluctuations. This, however, is not what happened. Catches of many of the world's major traditional commercial species, for instance Atlantic cod, haddock, saithe, and Atlantic herring, peaked around 1970 (Stamatopoulos, 1993; Grainger and Garcia, 1996). By 1990, there were serious depletions, among the most notable that of Barents Sea cod (OECD, 1993, 27).³ But the worst was yet to come. The year 1992 marked the collapse and closure of one of the world's great fisheries, the northern cod fishery of Newfoundland. This fishery, which supplied more than 10% of the world's cod as recently as 1988,⁴ and which was instrumental in the early exploration and development of North America (Innis, 1954), remained closed at least until the year 2000, and at that time, eight years after the initial closure, showed little sign of stock recovery (Fisheries and Oceans Canada, 2000). This was only the most dramatic and complete closure. Other total or partial closures, and quota reductions also occurred at about this time.⁵

In addition to the total collapse of the northern cod, 1992 was also a watershed in that an unequivocal and dramatic warning on the state of the world's marine fisheries was issued in that year, and was heard. The FAO (1992) noted that, while demand for fish products might continue to expand, global catches were near their limit, many stocks were overfished (FAO, 1992, 7) and the economics of fisheries were awry, with uneconomic fisheries being supported by subsidies estimated for 1989 at US\$22,000,000,000 (\$22B) to cover operating losses alone (FAO, 1992, 21). This figure rose to \$54B when capital costs were included (FAO, 1992, 60).

Twenty years after the expansion of national jurisdiction, the world's focus changed from concern with the development of the fishing industry to an overriding concern with the sustainability of fish stocks. Whereas the early economic analyses of fisheries emphasized open access as the cause of the overfishing problem, the decades leading up to the mid-1990s showed that fishery management techniques that simply limited access failed to protect the stocks. There developed renewed interest in Scott's idea of privatizing the fisheries, through the mechanism of Individual Transferable Quotas, thus focusing on the common property aspect of the fishery rather than on its open access characteristic. There also developed a keen interest in analyzing the role of subsidies in stimulating overfishing. The present report is concerned with subsidies in the context of overfishing.

¹Control over the 200-mile limit from the United States was authorized by the *Fishery Conservation and Management Act of 1976*, 16 USC 1801, the "Magnuson Act." The Act states that the reason for its enactment is the failure of international fishery agreements to control overfishing [Section 2(a)(4)] and that its goal is "a national program for the development of fisheries which are underutilized by United States fishermen (emphasis added). [Section 2(a)(7)]"

²The Capital Construction Fund and the Fishing Vessel Obligation Guarantee Program are discussed in detail in Chapters VI and VII of [U.S.] Federal Fisheries (1999).

³It should be noted that this stock recovered quite quickly.

⁴FISHSTAT and CAFSAC (1990, 46).

⁵From Georges Bank north, many, if not most, of the allowable catches of North Atlantic groundfish were sharply curtailed or the fishing grounds were fully or partially closed. For a discussion of cod and other failures, as well as the recovery of the cod stock in the Barents Sea, see Hannesson (1996).

Central to the problem of depleted fisheries, and one of the reasons why the problem of fishery subsidies has been as intractable as it has been, is that there are conflicting goals among participants in the fishery. Fishermen are concerned about income and employment, fishery operators are concerned about profits (either short- or long-term), fishery managers are concerned about husbanding the stocks while being alert to the political implications of their actions, retailers are concerned with steady supply and costs, and "communities" are collectivities concerned with survival.

The conflicting goals are less discernable when fish are plentiful and prices are high. At such times there is a tendency to expand production. However, fishermen, fish plants, and fishing vessels are immobile factors of production in the sense that they are difficult to transfer from fish to non-fish operations. Once in place they resist dislocation. Fish stocks, which may have been growing, are subject to natural fluctuations, and may begin to decline. The implications of conflicting goals become discernable when fish stocks decline, whether because of overfishing or because of natural variation. Facing such decline, the logical response of fishery managers ought to be to force a reduction in fishing effort. Unfortunately, the logical response is not always feasible. The factors of production, being immobile, for the most part have nowhere to go. Cutbacks in fishing effort mean less profit, less employment, less income for fishermen and fish plant workers and their families and pressure on fishery managers to minimize or cease the cutbacks. The situation is further complicated by the uncertainties associated with the biologists' estimates of the fish populations. There is usually sufficient doubt about the accuracy of stock assessments and predictions to make the need for effort reductions unconvincing to those whose livelihood depends upon being able to maintain their fishing income.¹ The failure to monitor the economic state of the fishery over time makes it impossible to know whether economic downturns are merely cyclical or endemic.

Given the uncertainties of fisheries, and the desire of government to implement policy, subsidies have come to play a number of roles in the fishery. Subsidies are used to encourage economic "development" when deemed appropriate, as during the "Americanization" campaign that followed passage of the *Magnuson Act*. They are used to maintain the incomes of firms and fishermen. They are used to stimulate fishermen and fish processors to remain in rural communities (OECD, 2000, 29). They are used to help reduce (or expand) fishing and fish processing capacity. They always serve somebody's purpose and are thus seen as being "good" by those who profit from them, while they may be seen as "bad" from other perspectives. From a general social perspective, subsidies that stimulated the Americanization program were seen as good subsidies in the context of policies intended to stimulate expansion of the fisheries. The same subsidies became "bad" when overfishing was recognized as a major problem and the social policy shifted to an emphasis on the sustainability of fish populations. Multiple social policies, unfortunately, can lead to conflicting views of the same subsidies at the same time. Concern with the environment, when a stock is overfished, would lead one to favor effective subsidies that reduced capacity while disfavoring expansionary subsidies. Yet at just such a time, a policy of maintaining rural communities would require subsidies that maintain the population, its income, and fishing capacity.

Subsidy programs have been developed in many contexts and in response to a myriad of political agendas. As a result, the rubric "subsidy" envelopes a host of ideas. The concept has been excessively fluid. There is no standard, universally understood, meaning of the word subsidy. The purpose of this exercise is not academic, it is to suggest a value neutral, generic concept of "subsidy" acceptable to a wide range of policy makers and analysts. It attempts to convert an amorphous and confusing, although widely used, term into an operational concept. In the next section we review a number of definitions of subsidies, not necessarily in the context of fisheries.

¹For challenges by fishermen to the scientific assessments, or their implications, see, for the European Union, the article "Quota Cuts Threaten Fishing Industry" in the British newspaper, *Daily Telegraph*, December 18, 1999, and for Canada, "Call for Quota Cut Angers Union" in the Canadian newspaper, *Globe and Mail*, January 19, 2000.

III. SUBSIDIES: GENERAL CONSIDERATIONS

A. Subsidies: Dictionary Definition

The word "subsidy" is ancient. The *Oxford English Dictionary* provides a reference from as early as 1387.¹ Nevertheless, the modern concept of subsidy as "financial aid furnished by a state or a public corporation in furtherance of an undertaking or the upkeep of a thing" dates only to the middle of the nineteenth century. Even with such a basic definition, we face the complexities of the word: does it refer, for instance, to both explicit financial aid and implicit aid? Clearly, the payment by the state of funds for "the furtherance of an undertaking" is a subsidy. But is waiving a tax, for instance, an exemption for fisheries from sales taxes, as has been policy for such American states as Maryland and Rhode Island (National Association ..., 1986, 280, 573) a subsidy? Is a loan guarantee, such as has existed in the American state of California, among others (National Association, 1986, 70), where no money is necessarily transferred, a subsidy? If such a loan guarantee is available to any small business, not only to fisheries, as in the case of California, and if loan guarantees are deemed to be subsidies, are they subsidies to the fishery, since they are available to any small business? Is a policy, such as that imposed by the *Jones Act* in the United States ([U.S.] Federal..., 1999, 41), requiring ships used in the domestic coastal trade to be built in American shipyards, a subsidy, despite the fact that no government funds are expended or taxes waived? If such a policy is deemed to be a subsidy, is it a "negative" subsidy to fisheries? After all, the price of fishing vessels can be expected to be higher in the face of such a policy than it would be otherwise because of the exclusion of international competition. The policy, therefore, imposes a financial penalty on the fishing industry.

Perhaps a philosopher could massage the words of the dictionary definition to arrive at a unique interpretation. The rest of us must face the question of "what is a subsidy" from a different perspective. Why do we want to know what is a subsidy? To what purpose will the definition be put? Is it possible to have a general definition of "subsidy" that is applicable to all situations?

As noted above, our concern for subsidies arises from a specific problem: overfishing. We then face two major questions. First, what definition, or definitions, of subsidies are potentially most useful to governments and intergovernmental agencies in determining policies whose objective is the maintenance of the sustainability of fish stocks? Second, what definition, or definitions, of subsidies have the greatest potential for being accepted by the international community for the purpose of developing policies to encourage sustainability?

In the remainder of this section, we review a number of alternative general concepts of subsidies not necessarily related to fisheries, *per se*.

B. Subsidies: International Trade, the GATT/WTO Context

The *Final Act* (GATT Secretariat, 1994) of the Uruguay Round of Multilateral Trade Negotiations initiated the transition from the General Agreement on Tariffs and Trade (GATT) to the World Trade Organization (WTO). The objective of the WTO is to develop a "fairer and more open multilateral trading system for the benefit and welfare [of the peoples of the world]. (GATT Secretariat, 1994, iv, v)" It then stands to reason that the concept of subsidies incorporated into the WTO agreements are those concepts most appropriate to the goal of diminishing restrictions on international trade. Subsidies that are purely internal to a nation, if such exist, are of no interest and would fall outside of the ambit of the concept of subsidies accepted by the WTO. It is also significant that the WTO agreement was negotiated by representatives from 124 nations, so the definitions must therefore be viewed as political compromises.

The WTO Agreement on Subsidies and Countervailing Measures (GATT Secretariat 1994, 264-315) defines subsidies as any of the following acts of a government or, more generally, a "public body," which "confer a benefit":

- a. transferring, or potentially transferring, of funds, such as

¹The Compact Edition of the *Oxford English Dictionary*, Oxford: Oxford University Press, 1971, 3127.

- i. grants
 - ii. government loans and loan guarantees when they require smaller repayments than comparable commercial loans
 - iii. government equity investment when the investment is inconsistent with standard investment practice
- b. foregoing government revenue (tax exemptions or tax credits);
 - c. providing goods or services other than general infrastructure at less than market prices;
 - d. purchasing goods at more than market prices; or
 - e. offering income or price supports.

There is an additional requirement of "specificity" in that the act of government, if the act is to constitute a subsidy, must favor a specific enterprise or group of enterprises and not be an act that is generally applicable to all enterprises. Thus a tax exemption for an industry is a subsidy, the removal of a tax from all industries is not. The WTO definition posits three classes of subsidies. The first, "prohibited subsidies," are any based upon export performance or which favor the use of domestic over imported goods, and these are expressly forbidden. The second, "actionable subsidies," are those against which action can be taken if they cause "injury to the domestic industry" of a country or seriously prejudice the interests of a country. The agreement further defines serious prejudice as occurring when there is an *ad valorem* subsidy greater than 5%, when subsidies cover an industry's operating losses, or when there is a direct forgiveness of debt either through the forgiveness of government debt or grants to cover debt repayment. Serious prejudice may arise if the effect of the subsidy is to displace or impede imports in the domestic market, or to impede or displace exports from a country to a third country, or if the effect is to undercut the price of products produced abroad or to increase to world market share of the domestic product.

The third category of subsidy, after prohibited and actionable, is "non-actionable subsidies." These are subsidies that are non-specific or which assist: (a) research by firms and universities; (b) a disadvantaged region; or (c) adaptations to new environmental regulations. The political aspect of the WTO definitions is clear here. Non-actionable subsidies have economic effects that are no different from actionable subsidies, yet they are expressly permitted presumably because they further activities favored by the members of the WTO.

Where an actionable subsidy can be shown to exist and can be shown to do material injury, a country is entitled to impose a countervailing duty against imports of the favored product from the exporting country. The countervailing duty can only be of sufficient magnitude to offset the offending subsidy.

C. Subsidies: International Trade, the Canada/United States Free Trade Context

In the context of a discussion of the United States/Canada Free Trade Agreement which became effective at the start of 1989, Hart, working from a Canadian perspective, took a much broader view of subsidies than would be consistent with the WTO treatment of the subject. Canadian law¹ has specified a subsidy as including "any financial or other commercial benefit that has accrued or will accrue, directly or indirectly, to persons engaged in the production, manufacture, growth, processing, distribution, sale, export or import of goods, as a result of any scheme, program, practice or thing done, provided or implemented by the government of a country...(cited in Hart, 1992, 33)" Consistent with this definition, Hart includes as subsidies: land grants and favorable regulation; infrastructure support (such as the United States' Tennessee Valley Authority and the joint United States/Canadian St. Lawrence Seaway projects); government purchases and other support to such United States industries as defense, micro-chip, aircraft and shipping; bounties; special duties; British Commonwealth preferences; American support of its space program; and Canadian support for cultural activities. Hart took issue with the concept of "fairness," ostensibly the basis of the WTO framework, as starting point for the analysis of subsidies because, in his view, fairness has no "objective intellectual basis". In the international field, WTO, free trade, and other agreements have a political basis and the details are the results of compromises. Any definition of subsidies that arises from these agreements is liable to be tainted by the political context from which they arise.

¹Special Import Measures Act, RSC, c. 25, §43, 1984.

Pushing Hart's broad view of subsidies even further, Stanford (1991) argued that governmental policies that lead to low wages, policies such as "right to work" laws, low or non-existent minimum wage laws and, by implication, laws which render more difficult the organizing of trade unions (such as the *Michelin Law* in the Canadian province of Nova Scotia which requires that workers in all geographically dispersed plants of a single company must favor the union for any plant to be unionized)¹ constitute subsidies to firms affected by those laws. Absent a belief in the desirability of the unfettered operation of free markets for providing an objective standard of what should be, a belief which would put the very existence of trade unions beyond the pale, Stanford's argument is cogent. His context, as with Hart, was the Canada/United States Free Trade Agreement and his concern was with the possibility of firms leaving one country (Canada) in favor of another (the United States) because of the lower labor costs in the latter. If one country, or part thereof, has legislation more favorable to labor than another, then is there not an implicit subsidy to business in the region with legislation less favorable to labor?

D. Subsidies: Domestic Considerations

Dr. C. S. Shoup, in a contribution to a *Compendium* prepared for the Joint Economic Committee of the United States Congress (Shoup, 1972, 55-73), approached the question of subsidies from a totally different perspective than the WTO. His concern was with the effects of subsidies on a domestic economy, in this case the domestic economy of the United States.

Distilled to its essence, Shoup's view is that a subsidy is a government payment, or tax relief, by which the government, seeking to accomplish its goal of reallocating resources for whatever purpose, attempts by incentives rather than penalties to achieve a change in the relative price of a product. Since the transmission mechanism depends on changes in relative prices, all products and all factors cannot be subject to the subsidy. Nevertheless, the subsidy can be very broad, encompassing "one, or several, or all households with respect to some one or more (but not all) uses of its or their incomes. (Shoup, 1972, 56)." There is clearly no analogy to the WTO concept of specificity. Thus, a broad tax incentive scheme such as the investment tax credit that comprised part of the U.S. tax code from 1962 to 1986, available to all industries, would fall under Shoup's rubric of subsidy, while it is explicitly excluded from the WTO's concept.

Shoup included an "intention" factor in his definition in that the government's purpose in granting the subsidy must be to induce the recipient of the subsidy to modify his or her behavior.

Shoup also made explicit the symmetry of his two forms of subsidy: government payments and tax incentives. The latter can be made identical to the former by imagining that the recipient of the subsidy pays the full tax and then receives a rebate (a government payment) for the amount of the subsidy. In fact, this method is precisely that used by Surrey in another paper included in the *Compendium* (Surrey, 1972). Surrey imputes the tax that would have been paid had the incentive not existed, and then allocates this amount as the cost to the government of the subsidy.

E. Subsidies: Diverse Applications to Agriculture

The world of agricultural subsidies is characterized by many forms of governmental economic support, each of which falls into one of two general classes, the first involving the reduction of consumer food prices below the free market level and the other involving the support of farm production. The first class, often used in developing countries, includes such diverse approaches as rationing in Pakistan and price controls in India (Pinstrup-Andersen, 1988). The second class, often used in developed countries, is also diverse, including such approaches as supply management and formula pricing in Canada and acreage controls and subsidized credit and insurance in the United States (Sanderson, 1990). In this section we briefly discuss a number of approaches to agricultural support. Our goal is not to be comprehensive but to illustrate the various types of support.

¹An Act to Amend Chapter 19 of the Acts of 1972, the Trade Union Act, Statutes of Nova Scotia, 28 Eliz. II, c. 78, 1978-79, Assented to 28 December 1979).

One distinction, admittedly fuzzy, is that between explicit and implicit subsidies. In the former, there are governmental budgetary outlays; in the latter, supply prices are suppressed. Explicit agricultural subsidies include such programs as purchases of agricultural surpluses and payments to farmers to keep land idle. Implicit subsidies include utilization of such techniques as exchange rate manipulation (whereby, for instance, there are official multiple exchange rates applicable to different categories of transactions), price controls, and quantitative restrictions on trade, as well as other methods of manipulating the terms of trade either for or against farmers. By overvaluing domestic currency, for instance, the government provides an implicit import subsidy to consumers while placing an implicit tax on producers since it forces domestic farmers out of international markets. Trade barriers are usually intended to protect non-agricultural industry, with the agricultural sector being doubly disadvantaged, first through the reduction in the prices it receives for its products and second by an increase in its costs, particularly the costs of imported machinery and supplies. Implicit subsidies to consumers are in effect negative subsidies to farmers, although the term "negative" is not often used in this context. Rather the term "implicit taxation" is used. But from this brief description, it is also clear that implicit subsidies to the industrial sector may, in effect, be negative implicit subsidies (or implicit taxation) to the agricultural sector (Valdés, 1988).

A combination of subsidies in both consumer price reducing and farm support classes has been applied in Mexico. Under this system, which was applied for maize and a number of other products, the government purchased domestic farm products at a guaranteed price and sold the raw products to processors at a lower price, absorbing the difference itself. The government absorbed, in addition, storage and distribution costs. The processed goods were then sold at prices set by the government. While the system may be complicated, its essential nature is simple: the government manipulated both the price received by farmers and the price paid by consumers (Lustig, 1988).

As was noted above, the focus of United States agriculture subsidies has been on farm support. Since the late 1930s, the United States has implemented a vast array of programs to manipulate the production and sale of agricultural products. Gardner (1990) lists a range of such programs. There have been direct payments from government to farmers: payments for idle acreage, payments on allotment-based output, payments for diverting acreage from one commodity to another, subsidy payments to support alternative uses of farm products, purchases of agricultural surpluses, storage payments, storage payments, and disaster payments. There have been tax shelter programs that were in effect tax waivers. There have been moves towards making programs self-financing by levying assessments on producers to fund farm product purchases as part of price support programs, in effect a tax on farmers to support specific payments to farmers. There have been loans at less than market rates of interest. There have been payments in kind. There have been price support and export subsidy programs that may or may not have involved direct payments by the government. There have been export promotions which involved government payments, but not directly to farmers. There have been import tariffs that were not only not a cost to the government but a source of revenue. There have been policies, such as marketing quotas, import controls and price discrimination schemes that, other than management costs, were essentially cost-free to the government. The range of such programs has been extremely broad.

Gardner implicitly considered all of these programs to be subsidies. He ended his overview of programs with the heading "other subsidies" where he listed such items as federally supported research and extension programs, federally supported infrastructure programs (e.g., electricity and irrigation projects) and exemptions from selected labor and environmental regulations. Gardner noted that the items listed in his "other subsidies" category "are not usually considered subsidies in the same category as deficiency payments." Gardner took a very broad view of subsidies.

Agricultural subsidies take a wide variety of forms, these forms varying from country to country, and from time to time. Lists similar to that presented for the United States can be prepared for many countries but it is not necessary for our purpose to do so. Our only concern with agricultural "programs" is to demonstrate the range of programs which might broadly be thought of as "subsidies," and for this purpose, the examples of Mexico and the United States should be more than adequate.

F. Subsidies: A Potpourri of Definitions

Hufbauer and Erb (1984) discussed a range of meanings of subsidies, from the narrowest view of all which appears in the system of national accounts of the United Nations to a broad view of Malmgren *et al.* which was criticized by Hufbauer and Erb as being too broad.

In its system of national accounts, the United Nations (United Nations, 1982, 124, cited in Hufbauer and Erb, 1984, 9) defined subsidies as "all grants on current account which private industries receive from government ... These [transfers] ... represent additions to the income of the producers from current production ... Transfers by public authorities to private industries for investment purposes or to cover destruction, damage, and other losses in capital and working assets are classed as capital transfers rather than subsidies."¹ A somewhat broader definition is that of the Joint Economic Committee of the United States Congress (JEC, 1965, cited in Hufbauer and Erb, 1984, 9), which said: "An act by a government unit involving either (1) a payment, (2) a remission of charges, or (3) supplying commodities or services at less than cost or market price, with the intent of achieving a particular economic objective..." Criticism of these definitions (Malmgren, Golt, Kingston & Co., cited in Hufbauer and Erb, 1984, 10) are, first, that the definitions disregard "the principle of public finance theory that the effect rather than the form of a transfer is what is important." Thus an unsatisfactory distinction would be made, for instance, between funds spent by a government operated workers' training scheme that would not be considered a subsidy because no payment is made from the government to the firm, and a grant from government to a firm for worker training which would be considered a subsidy. Second, the terms used in the definitions are themselves vague. For instance, the full UN definition includes the expression "the current costs of production," an expression subject to sufficiently divergent interpretations as to add confusion rather than precision to the concept of subsidy. Third, the distinction between capital and current accounts is largely artificial. Again, in this respect, the definition is sufficiently imprecise as to increase, rather than decrease, confusion. Hufbauer and Erb took exception to the Malmgren *et al.* criticisms, finding them too sweeping. They believed that to meet the Malmgren objections, all government assistance to industry would have to be considered as subsidies "whether the assistance is in the form of an outright grant, interest-free loan, protection from imports, or is bestowed less visibly through tax exemptions ... or relaxed health and safety or environmental regulations." Hufbauer and Erb (1984, 10) concluded that "an all-encompassing definition would prove too sweeping for policy guidance," and that nobody at this point in time would "condemn all forms of government intervention," implying that they consider that anything called a subsidy is necessarily "bad". We present this brief synopsis of the Hufbauer and Erb discussion because it will be useful to refer back to it below.

The preceding survey illustrates all too clearly Houthakker's point that the concept of subsidies eludes definition. At one extreme, subsidies are interpreted so narrowly as to be limited to government financial transfers to firms on current account (as in the United Nations definition). At the other extreme, subsidies are understood so broadly (by Gardner, Hart, and Stanford) as to include a vast array of legislation concerning labor organizing, minimum labor standards and waivers of environmental regulations, none of which need involve government finance at all.

G. Subsidies: An Enveloping Concept

Although motivated by the search for solutions to the problems of fisheries, Schrank and Keithly (1999) sought an umbrella concept that envelopes all of the ideas presented above, and would not be limited in application to any particular industry.

Hufbauer and Erb, in their criticism of Malmgren *et al.*, consider Malmgren's views to be "too sweeping for policy guidance" in that all government assistance to industry would be included under the rubric of subsidies. They rejected such a broad concept not only because in their opinion it would not be

¹The latest version (United Nations *et al.*, 1993, 173-174) is not substantially changed. The System of National Accounts separates payments on current account to firms, which it calls subsidies, from payments on capital account to firms, which it calls capital transfers, and from payments to final consumers, which it calls social benefits. The System of National Accounts, however, recognizes multiple exchange rates (cited above with reference to agriculture) as implicit subsidies or implicit taxes depending upon whether the multiple exchange rate system is beneficial or deleterious to the firm (United Nations *et al.*, 1993, 329-330, 435).

helpful for policy guidance but also because all subsidies are "bad," and nobody would consider that all government assistance is bad and should be abandoned. The implicit conclusion from these comments is that Hufbauer and Erb desired a narrow definition which would exclude what others would call bad subsidies.

Schrank and Keithly worked from a different premise. They argued that subsidies are not necessarily evil, and that it serves no purpose to label a word as a pejorative and then restrict its use accordingly. Besides, as we noted earlier, a government policy that at one point in time is socially desirable may later become undesirable. It did not seem to Schrank and Keithly that when the policy is no longer seen as being socially useful it becomes a subsidy whereas earlier the same policy was not a subsidy. Similarly, what one individual views as "evil" in the realm of economic policy may be seen by another as a superior "good." According to Schrank and Keithly, what is required is a framework for analysis. A government takes an action (or foregoes taking an action). The question to be asked, they believe, is: What are the anticipated results of the action, both in general on the body politic and more specifically with respect to the industry of concern to the analyst? Thus a government subsidization of chemical fertilizer in agriculture should be analyzed from a number of perspectives: agricultural production, the long run effects on agricultural land, and the effects of water runoff on waterways (and therefore on fish and other aquatic life), all in the general context of current social policy. Hufbauer and Erb are correct that this view of subsidies is "sweeping", but they are not correct that this renders the concept useless for policy guidance or analysis. Rather than define subsidies as something that is evil, it would seem preferable in the view of Schrank and Keithly to define subsidies in a broader manner that enables the concept to be used, without preconceptions, for economic, social and political analysis. The results of the analysis can then be evaluated to determine which aspects of the subsidy are favorable and which are unfavorable from a social and economic policy standpoint, and the decision can then be made as to whether the subsidy is at that time, on net, beneficial or not. The subsidies would then be evaluated to see if they aid or hinder the financial health of a firm or industry.

Policies that hinder are referred to by Schrank and Keithly as "negative" subsidies. We have used this term above as being synonymous with the more frequently used concept of "implicit taxation." The Schrank/Keithly definition is that a subsidy is a "government action (or inaction) that modifies (by increasing or decreasing) the potential profits earned by the firm in the short-, medium-or long-term."

While exceedingly broad, this definition incorporates all those that appeared in the survey presented above. Accepting it as a working definition would remove the issue of "what is a subsidy." The focus could, as it should, turn away from disputes or vagueness over definition in favor of analysis of the effects of individual subsidies. Once the analysis is complete, policy decisions concerning whether the subsidy programs should be implemented, expanded, or abandoned can be made. We return to this subject later in the paper, after we consider the concept of subsidies in the context of fisheries.

IV. SUBSIDIES: FOCUSING ON FISHERIES

A. Fisheries Subsidies: the FAO

In its warning on the state of the world's fisheries (FAO, 1992), FAO indirectly estimated the value of the world's subsidies. Subsidies were neither defined nor directly computed, so the concept of subsidies used was implicit. Subsidies are simply the negative of the difference between total revenues received by the world's fishing fleet less the total costs. As we noted earlier, this difference in 1989 was US\$22B when costs were limited to operating costs, and US\$54B when investment costs were included.

FAO landings statistics for major commercial species are considered reliable (FAO, 1992, 19). The lack of cost and revenue data for the world's fisheries was remarked on earlier in this report. For 1989, the FAO gathered "rough indicators" (FAO, 1992,19) of the average unit values for these major species. The inner product of the unit price and quantity vectors provides an estimate of revenues.

Operating costs are taken to be labor, fuel, insurance, maintenance and repairs, and supplies and gear. Total costs are the sum of operating and capital costs. FAO has published rough estimates of the size of the world's fishing fleets, by size of vessel (FAO, 1991). New construction costs by vessel size and type were obtained from shipyards. The inner product of cost and vessel type vectors gives an estimate of the total replacement value of the world's fishing fleet. In the absence of data for current market values and the

age distribution of the fleets, it is impossible to compute depreciation. Replacement value was therefore used as the basis for the cost computations. Each class of operating cost was computed as a percentage of replacement costs, the percentages based upon surveys (FAO, 1992, 58). Where possible, the cost estimates obtained in this way were cross-referenced to other known data. Annual capital costs were computed as 10% of the replacement cost, where 10% was taken as the rate of return that would equal opportunity cost of the vessels (FAO, 1992, 60).

What, then, is implied by the FAO calculations for the concept of subsidies, where the value of subsidies is estimated as the difference between revenues and costs computed as described?

Let us assume that both the computed revenues and costs reflect true market prices and that these, in turn, reflect social costs and revenues. To the extent that revenue enhancing subsidies (e.g., price supports) and cost reducing subsidies (e.g., fuel tax exemptions) are reflected in the FAO's revenue or cost estimates, then the true magnitude of the subsidy is underestimated by the FAO. For the purposes of the present analysis, we ignore this possibility. Then, assuming that the fishing fleets on the world scale at least break even economically, somebody must provide the value by which costs exceed revenues. These are the implicit subsidies computed by the FAO. Revenue enhancing subsidies, such as grants to fishing operators and price support payments that are not reflected in the computed revenues are clearly being incorporated into the FAO's concept of subsidies. Symmetrically, cost reducing subsidies, such as fuel tax exemptions, provision of bait, and less than market interest rates, also clearly are incorporated into the FAO's concept of subsidies.

B. Fishery Subsidies: the OECD

The OECD has maintained a long term interest in the role of governmental financial assistance to the fishing industry, an interest dating at least to the 1987 adoption by the Committee for Fisheries of the goal of seeking "transparency on economic assistance measures, direct as well as indirect, and to develop an analytical framework to help understand how these measures affect the industry. (OECD, 1993)".

In the same year that the FAO sounded its warning on the state of the world's fisheries, the OECD issued an inventory on government assistance to fisheries (OECD, 1992). The report started from the premise that the GATT's narrow concern with the international implications of subsidies was too limited and that approach of the OECD would be broadened to include domestic measures. Noting that "only a few countries admit to having 'real' subsidies," the OECD essentially abandoned the term subsidies in favor of the more cumbersome expression "assistance instruments." Assistance instruments were divided into two classes, "border measures" and "domestic measures."

Border measures relating to the harvesting sector were divided into two classifications, restrictions on access to the fishery and restrictions on foreign direct investment. Restrictions on access are pursued through fishery management techniques: the licensing of vessels and fishermen. Discriminatory regulations favoring the nationals of the coastal state are virtually universal and the success of such discrimination was seen as one of the chief goals of the extension of fisheries jurisdiction in the mid-1970s. Restrictions on foreign direct investment may take many forms, including ownership restrictions, allocations reserved for nationals, nationality and residence of company officials and crew restrictions. These barriers to the free flow of "harvesting services" are seen as implicit assistance to the fishermen who are permitted to fish.

Domestic measures were also divided into two classifications: assistance for social reasons and direct economic assistance to solve immediate problems.¹ Among social measures are government fully or partially funded insurance programs (such programs in Iceland, Japan and Sweden are noted), regional development programs (primarily through infrastructure development and, as in Japan, improvement of fishing grounds), social welfare (unemployment insurance in Canada,² minimum wage and vacation legislation in Norway) and tax incentives either through accelerating depreciation on capital assets or through deferred taxation (in the United States). These are long term and continuing programs.

¹Note the focus on "intent".

²This specific example is not cited.

Quite different from social assistance is "direct economic assistance", which, at least theoretically, is introduced for a specific short term purpose to be discontinued when the program's objective has been realized. Such direct assistance includes "operational subsidies" (no euphemism here) which include government provision of credit on favorable terms, fuel subsidies, price regulation and other price support. The report questions whether insurance schemes are subsidies when the fishermen pay premiums. In such cases, government intervenes in the provision of insurance because risks are greater in fisheries than in other industries, and banks and insurance companies are hesitant to encounter these risks. This argument is unconvincing since, presumably, there is a risk premium that would convince even the most conservative financial institution to sell such insurance. The risk premium might be so high as to render the fishing operation unprofitable, thus requiring government insurance if the industry is not to be left without insurance altogether. There is clearly an insurance subsidy equal to the difference in premiums between government and putative private plans. This subsidy has both environmental and efficiency consequences since it encourages the expansion or maintenance of fishing capacity.

The OECD report considered a second category of direct assistance, assistance for "Modernization or Diversification and Development". Included here were grants or loans for fleet restructuring, improving gear and safety, and for conversion to fishing for underutilized species, as well as "institutional support," such as sanitation regulations and safety standards that apply to all industries, not just fishing. The report noted that institutional support is rarely directly accounted for in fisheries. In the Schrank/Keithly categorization, the sanitation or safety restriction would be classified as a negative subsidy, as it imposes costs on the firm. Any financial transfer from the government to the fisherman to compensate for the costs of obeying these regulations would be a positive subsidy. The net subsidy would be the algebraic sum of the effects of both the positive and negative subsidies on the anticipated profits of the firm. The costs of fishery management are also included as institutional support and it was noted in the OECD report that most fishery management costs for most countries are borne by the government. Australia was cited as an early exception where 90% of such costs in certain fisheries are expected to be recovered.

Recognizing the symbiotic relation between fish harvesting and processing, the OECD report proceeded to consider border and domestic measures affecting the fish processing sector. The key border measures affecting the processing sector are tariffs and tariff quotas (where higher tariffs are imposed when imports exceed certain specified amounts) as well as non-tariff barriers in the form of import quotas, landing bans, and restrictions on direct investment by foreigners.

Domestic measures include investment incentives and incentives for structural adjustments, market research, programs to stimulate domestic and foreign fish consumption, fish marketing boards, and price supports. Other measures include unemployment relief, emergency loans, input subsidies (which would tend to lower the market price), and state purchase commitments (which tend to increase prices), direct grants, interest rebates and tax benefits.

Two years later, in 1994, the OECD sponsored an expert consultation on environmental subsidies (Pearson, 1995). The consultation accepted the need, when focusing on environmental issues, to broaden the concept of subsidy beyond the GATT emphasis on trade distortion and specificity, and it was not shy about using the term subsidy. Starting from the bifurcation of subsidies into general and specific categories, the consultation accepted that subsidies specific to a firm or industry have a greater effect on trade than a general policy such as an investment tax credit. The consultation report went on to note, nevertheless, that an investment tax credit can affect the choice of factor inputs in production, can therefore have a differential impact on different industries, and therefore may favor or disfavor fisheries. Education programs also can affect the competitive position of a firm or industry in a country. With a nod to current international events, the consultation viewed ex post cleanup subsidies as desirable, particularly in eastern Europe given the political changes that had recently occurred there. Similarly, international subsidies, such as may be granted by the World Bank, were viewed by the consultation as foreign assistance and not as trade distorting subsidies. This distinction, it appears to us, is arbitrary and politically motivated. By any objective standard, foreign assistance of this sort is a trade distorting subsidy. It may or may not be considered beneficial, a "good" subsidy, but in our opinion it remains a subsidy nonetheless.

The consultation also favored excluding environmental research and development from the framework of subsidies, as long as control of the technology developed did not pass to the private sector. The

consultation could come to no decision concerning "upstream environmental subsidies," or of subsidized inputs to other industries, such as subsidized fertilizer to agriculture and low stumpage fees to forestry. Clearly going beyond the GATT conception, the consultation considered the effects of maintaining artificially low environmental standards or of failing to enforce the standards that exist, concluding that such "implicit environmental subsidies" are important and must be considered, but that they should not be countervailable. Financial assistance conditional upon pollution abatement was seen by the consultation as lowering a firm's cost of doing business which could therefore bring more firms into the industry, thus in the long run potentially increasing pollution. This form of subsidy was therefore viewed as undesirable.

The most recent OECD document (OECD, 2000) quite self-consciously, included "government financial transfers" and not "subsidies" in its title. Milazzo¹ explains that certain categories of government financial transfers, in particular "general services", including fishery management, science and enforcement, are believed not to be subsidies by "most fishery managers and policymakers". Milazzo made the distinction between managers, on the one hand, who generally hold to the position that general services are not subsidies, and fishery economists on the other, who tend to believe "that a failure or unwillingness of a government to charge such fees at an adequate level is an implicit subsidy." The distinction becomes critical when it is realized that "government financial transfers in OECD countries are dominated by general services (OECD, 2000, 33)." In fact, the OECD report noted that 77% of all "government financial transfers" fell into the "general services" classification. Clearly, if general services were included under the rubric of subsidies, the magnitude of subsidies would be much higher than otherwise. Given the general attitude that subsidies are somehow "bad", such treatment of subsidies would have political ramifications. These comments emphasize the foolhardiness of treating subsidies as universally "bad"; it leads to potentially endless diversionary discussions as to what kinds of activities are to be viewed as subsidies when the important thing is the role that these activities play in the economy. Milazzo further comments that the key problem in dealing with subsidies is that there are now two major policy issues involved, international trade and resource conservation and that "sorting out these aspects of the issue is complicated and contentious."

In the OECD study, the sequence for analysis started with the classification of transfers according to how they are implemented, then shifted to the determination of the magnitudes of the transfers, and ended with the evaluation of the impacts of the transfers on industrial operations (fishing and processing) and on conservation (the sustainability of the fishery). The study then divided transfers into four categories: (1) direct payments from government budgets; (2) cost reducing transfers; (3) general services (e.g., transfers from government budgets for fisheries managements, infrastructure, and free berthing at ports); and (4) market price support (transfers that influence both consumer and producer prices).

There are some puzzling aspects in this classification scheme. First, the word "subsidy" is carefully avoided, except in a few specific cases. Presumably the Fisheries Committee of the OECD is trying to avoid the "good"/"bad" connotations of subsidies and is attempting to finesse this problem by lumping everything as a "government financial transfer," a neutral term that carries no emotive baggage. The OECD definitions appear to be tied to a public finance view of the issue, all items listed being either government expenditure items or items of foregone income with the sole exception of loan guarantees which, by themselves, involve no direct or implicit government expenditure unless the guarantee has to be honored. The fairly comprehensive list of transfers included in the OECD study is incorporated into the list in Section VI of this report, although with slightly different categories.

C. Fisheries Subsidies: Diametrically Opposed Views from West Africa

Mabawonku (1990), in his study of fishery subsidies in West Africa, defined a subsidy as "that transfer payment given to fishermen in cash or in kind to enable them to increase effort in order to secure increased output."² Mabawonku set his definition of subsidy explicitly in contradistinction to "financial support" which "includes subsidy and other capital and recurrent expenditures that are not directly transferred to the fishermen and sometimes involves administrative costs and others which do not directly

¹E-mail message from M. Milazzo, United States National Marine Fisheries Service to J. Dirlam, Emeritus Professor of Economics, University of Rhode Island, March 23, 2000.

²Mabawonku (9) at one point generalizes this definition to encompass "that amount of resources transferred either in cash or in kind to the fishing industry (artisanal and industrial) in order to induce investors to invest in fisheries or such other purposes as related to government objectives."

enter into the fish productivity/fishing effort relationship." This is a particularly sharp, if narrow, definition of subsidy, with subsidies being defined, first, by intent, the government's goal of expanding production, and second, by the transfer of funds directly to fishermen for operating and capital expenditures. In the abstract, subsidies were viewed by Mabawonku as a means by which a government could achieve its policy objectives in a cost effective manner, the chief policy objectives in the context of developing economies being income stabilization, income redistribution, promotion of favorable technologies, increasing output in desired sectors, reducing consumer prices through reduction in production costs, raising producers' incomes above market levels, promoting resource exploitation where private initiative is lacking, and stimulating private investment.

Although the countries of West Africa used a variety of subsidy tools, they all used subsidies to counter the problems of low and inefficient production (hence, subsidies for technological development), declining catches because of the aging of vessels (hence, subsidies for capital improvement) or rising input prices (hence, subsidies to reduce production costs), and in general, to prevent declines in national income.

Among the West African subsidy programs cited by Mabawonku were Nigeria's 1980s programs of selling of fishing materials to fishermen at 50% of the market price, providing infrastructure (landings and jetties, refrigerated vans), providing credit at subsidized interest rates, and establishing institutions such as cooperatives. It is clear from the context that Mabawonku's definition of subsidy is more general than at first appears, with "transfers to fishermen" not simply implying direct transfers to fishermen but rather transfers for the benefit of fishermen, a much broader concept.

The Gambia's subsidies included duty-free fuel imports for Gambian vessels, subsidies on fishing equipment used in the artisanal fisheries, and subsidized interest rates on loans. Senegal subsidized fuel and export promotion, the latter by the waiving of export duties. The Ivory Coast offered virtually no support to the artisanal fisheries and mainly supported the industrial fisheries by the provision of infrastructure – the construction of a fish harbor complex. Despite Mabawonku's narrow definition, the range of subsidy instruments he discussed was substantial.

Mabawonku considered that the West African commercial fisheries were underdeveloped and that, given the lack of technical knowledge and capital, it was only the existence of government subsidies that made it possible to begin the commercialization of the fishery sector. Given the immobility of factors, especially labor, and in the absence of fully developed and fully monetized markets, he stated that conventional arguments to the effect that subsidies encourage inefficiency by shifting resources from the most to the least productive sectors of the economy is simply false. In essence, Mabawonku considered subsidies to be "good" by encompassing under the rubric subsidy those government programs that support economic development.

The FAO (1995, 37) has suggested that there is still room for expansion in the West African fisheries but that unless effective management is introduced, the increased productivity resulting from improved technology will recreate the same problems in this area that exist elsewhere. In fact, the total marine catch in the Gambia, Nigeria and Senegal expanded rapidly, presumably partly in response to the subsidies discussed, nearly doubling from 395,000 mt in 1984 to 711,000 mt in 1997 (FAO FISHSTAT).

Perhaps in response to this expansion in output, Horemans (1996) viewed subsidies in the context of the artisanal fisheries of West Africa as an unmitigated "bad." Since most West African artisanal fisheries are open access fisheries, subsidies to individual fishermen would, in equilibrium, simply increase effort beyond that which would exist in an unsubsidized free access fishery, a totally negative result. In contrast to Mabawonku, who saw the West African artisanal fisheries, for whatever reason, as not having expanded to the socially optimal level, much less to Gordon's bionomic equilibrium, Horemans saw the West African artisanal fisheries as having reached Gordon's equilibrium. Either one of these authors is simply wrong or else the state of the fishery changed dramatically during the early 1990s. Our concern is not their correctness but rather how they perceive subsidies.

Horemans differentiates "subsidy," which he defined as "a financial transfer from one economic agent to another," from other, in his opinion more desirable, instruments of government policy: provision of infrastructure, market research, market promotion and similar programs. He defined direct subsidies as

financial transfers made directly from the government to a producer. In West Africa, the most frequently used direct subsidies involved the provision of fuel at less than market prices. Indirect subsidies rest upon market manipulation, such as high import tariffs on fish which permit local fish producers to charge higher prices. Contrary to the view of the 1994 OECD conference referred to above, Horemans also considered international support, such as the financing of international aid projects, preferential import tariffs governed by international conventions, and loans on preferential terms from international financial institutions, to be subsidies. Using the classifications of the OECD's *Inventory of Assistance Instruments* document, Horemans categorized subsidies as social or economic programs. Among African social programs were emergency programs (such as aid to Beninese fishermen after floods and aid to Liberian fishermen after a civil war), regional development programs (such as direct grants and loan guarantees to support employment in rural fishing communities), social welfare programs (such as seasonal unemployment relief, and provision through the World Food Program of food rations to Tunisian fishermen), and fiscal incentives (such as exemption from duties on gear). Among economic assistance programs were operational subsidies (such as reduced fuel prices, less than market interest rates, price support programs such as export subsidies, and import tax reductions), subsidies for modernization and diversification (such as subsidization of gear replacement in the Ivory Coast), subsidies for the development of the fishery (such as below market interest loans for gear, maintenance, repair and construction of infrastructure, and cost-free provision of goods and services).

Whereas Mabawonku and Horemans took diametrically opposed views of the role and desirability of subsidies, their argument became somewhat confused because they used different definitions of subsidies. Horemans, in particular, simply ruled that desirable subsidies were not subsidies, they were "other instruments of development." We repeat once again that a broad definition of subsidies is preferable. Then, individual subsidies can be evaluated as desirable or not, and suitable policy positions taken without falling back on fruitless arguments concerning the abstract nature of subsidies.

D. Fisheries Subsidies: Examples from the European Union

Having surveyed West African fishing subsidies, it might be useful to briefly identify the range of fisheries subsidies implemented in a political entity of the economically developed world. We take as an example the European Union.

Financial support for the fisheries of the European Union increased dramatically during the 1980s. Fishery subsidies during this period included grants and low cost loans for the construction of new vessels, the modernization of older vessels, and gear, import restrictions, tariffs, limits on foreign landings, export support, payments for withholding fish from market, price supports, fuel subsidies, construction of ports and marketing facilities, free access by EU fishermen to the fish resource, support for education and training and for research and development, and fisheries administration provided free of charge by governments (Fishery Economics Research Unit, 1984; FAO, 1992, 25-26). Since 1994, EU funds for fisheries have been consolidated under the Financial Instrument for Fisheries Guidance (FIFG). The emphasis of the FIFG has been on grants for the reduction of capacity, renewing or modernizing the fleet and gear when capacity reduction objectives have been achieved, infrastructure (e.g., ice machines), improving marketing and processing, and promoting fish consumption (European Commission, 1997, 42-43). The EU maintains price supports and offers start-up support for producers' organizations, as well as continuing support to improve the quality and marketing of fishery products. In addition, the EU pays to permit its vessels access to non-EU fishing grounds, for monitoring and enforcement of fishery regulations, and for research (OECD, 2000, 20-23).

E. Fisheries Subsidies: Milazzo and the World Bank

In 1998, The World Bank published Milazzo's *Subsidies in World Fisheries: A Reexamination*, the most comprehensive study to date on the nature and magnitude of fishery subsidies. Milazzo concluded that the world's fishery subsidies fell into the range of US\$14B to US\$20.5B. Our concern is neither with Milazzo's methodology for computing the value of subsidies nor with the estimates themselves. Milazzo's work is of direct relevance to the present paper in that in order to obtain his estimates, he first defined the concept of subsidies and then applied his definition to fisheries. In the course of doing so, he raised interesting questions concerning the concept of subsidies. Our interest lies in these interpretations and questions.

Milazzo started by limiting his focus to those government programs that fall under the ambit of the WTO agreement, that is, that affect world trade.¹ He then further limited his focus to subsidies that have an impact "solely or primarily" on the harvesting sector, thus to a large extent neglecting subsidies that have their primary impact on fish processing and marketing. These, too, may have an impact on harvesting, if for no other reason that in some locations the fishing industry is vertically integrated, with all three sub-sectors, harvesting, processing and marketing, under the same ownership. But even without integrated ownership, a policy that encourages expansion in one sector may well stimulate expansion in the others.

Milazzo recognized that a subsidy may be favorable or unfavorable (i.e., it is not necessarily "bad"), depending on its incentive effects. He also brought "intent" into his analysis, as when he referred to "subsidies that are designed primarily to restore the health of fisheries... (13)."² There is, however, no need to introduce the subjective factor of "intent" into the analysis. It is not intent that matters, but, as was implied by Malmgren *et al.*, the effect. A government policy can be adopted with the intent, or ostensibly with the intent, to accomplish the specified purpose, but it may accomplish precisely the opposite.

Milazzo's technique was to discuss and value various kinds of fishery subsidies as they existed in six major fishing nations, or groups of nations (Japan, EU, Norway, United States, Russia and China) and then project from these figures to obtain global estimates. He categorized subsidies as: (1) "budgeted subsidies: domestic assistance"; (2) "budgeted subsidies: foreign access"; (3) "unbudgeted subsidies"; (4) "cross-sectoral subsidies"; (5) "Resource rent subsidies"; and (6) "conservation subsidies".

Subsidies in the first category are identifiable in government budgets as the subsidies paid through the fisheries agency. To illustrate how Milazzo categorized subsidies in this class, taking samples from his discussion of Japan, there was a breakdown into a public sector component which generally falls under the rubric "infrastructure", and a "nonpublic" expenditures component which includes expenditures for recruiting young fishermen, aiding fishing cooperatives, aiding boat owners, marketing, consumer education, price stabilization, gear development, and vessel insurance programs, all activities, as Milazzo pointed out, that tend to increase capacity. All of the programs in each of these components is a drain on the government budget. For the European Union, "budgeted subsidies: domestic assistance" were divided into structural programs, including adjustment of fishing effort and protected marine areas (both tending to reduce effort and capacity) as well as fleet renewal and modernization, port facilities, processing, marketing and product promotion, on the one hand, and price support programs (all of which tend to increase effort and capacity), on the other.

Among European Union subsidies appearing in the above list were infrastructure expenses on port facilities. Tying the concept of subsidies to the WTO definition creates difficulties of interpretation regarding infrastructure expenditures. Section 1.(a)(iii) of Article 1 of the WTO Agreement on Subsidies and Countervailing Measures states that subsidies exist if "a government provides goods or services other than general infrastructure...." Milazzo (1998, 53-55) pointed out that the undefined term "general" is problematic, implying that specific infrastructure projects might fall under the rubric of subsidies, and he discussed criteria, particularly specificity with respect to the fishing industry, that could be used to make the distinction, concluding that some infrastructure expenses, particularly for Japan and the European Union,

¹However, as we shall see, he goes beyond this limit.

²Recall that the Joint Economic Committee included the role of "intent" in its definition of subsidies, as did Shoup.

were in fact subsidies. There would be no question that they would be included as subsidies under the Schrank/Keithly definition.

The question of specific infrastructure subsidies being actionable under WTO rules will no doubt be a developing area of international law, as Milazzo suggested. Legal interpretations change over time, however, and tying an analysis of fisheries subsidies to international trade regulations when the real concern is functional, i.e., the effect of subsidies on capacity and fishing effort, means that with new legal decisions, certain items previously included or excluded from the definition of subsidies will have their status reversed. Thus, tying subsidies to the WTO rules means that an essentially arbitrary decision might lead to the reclassification of a government action from being a subsidy to not being one, even though analytically, from an economic or social perspective, nothing has changed.

Perhaps the clearest example of such a case is that discussed by Milazzo (1998, 61-62) concerning United States countervail decisions arising from disputes with Canada relating to Canadian exports of softwood lumber to the United States. In 1982, the US Coalition for Fair Lumber Imports petitioned for a countervailing duty based upon low Canadian stumpage fees and had their claim rejected by the US International Trade Agency. In 1986, the same group filed essentially the same complaint and won its case (O'Brien, 1998, 39). From a functional economic perspective, such a change must be viewed as arbitrary. In seeking an operational meaning of the term "subsidy," such arbitrariness, which is probably related to political considerations, is to be avoided. Milazzo seemed well aware of this fact. While his general framework was that of the WTO, he interpreted the framework somewhat elastically, as in his discussion of infrastructure expenditures.

Subsidies in Milazzo's second category, "budgeted subsidies: foreign access", are funds paid by a nation on behalf of its fishing fleets to another nation to gain fishing rights for its fleets in the other country's waters. An example is the annual payment made by the United States government to several Pacific island nations to permit the United States' distant water tuna fleet to operate in southwest Pacific waters. Milazzo made clear that these payments are subsidies under the WTO agreement. It is also clear that these payments encourage fishing effort, although not in the coastal waters of the state making the payments.

Milazzo's third category, "unbudgeted subsidies", includes expenditures of non-fishery agencies of government and other classes of government support that are inherently unbudgeted or underbudgeted, such as subsidized loans, tax waivers, accelerated depreciation and loan guarantees. As difficult as it may be to estimate the dollar value of subsidies in Milazzo's first two categories, the problem becomes far more serious in the case of unbudgeted subsidies. There may be virtually no cost to government of a loan guarantee but the existence of the guarantee itself explicitly qualifies the action as a subsidy under WTO rules. The capacity augmenting stimulus of such a loan guarantee can clearly be very great, although it may be difficult to quantify the financial effect on the firm receiving the subsidy.

Fuel tax exemptions also fall into this category of unbudgeted subsidies. Milazzo concluded (Milazzo, 1998, 48) that fuel tax exemptions are environmentally harmful since they both contribute to increased fishing effort and to energy wastage. Fuel tax exemptions for fishermen are clearly subsidies under the WTO definitions, as they are under the Schrank/Keithly criteria. Yet were one to apply the fairness argument which is supposed to underlie the WTO rules, the issue of the fuel tax exemption becomes more complicated. Take, for example, the situation that exists in the United States, where a portion of fuel taxes (gasoline and diesel) are earmarked for road construction and maintenance. Since fishing vessels do not make use of the roads, it would be "fair" for them to be exempted from the tax, or at least that portion of the tax that is earmarked for roads. The criterion of "fairness" suggests one interpretation of the fuel tax exemption, while the WTO rules lead to another. An analytical model, considering the effects of the exemption on the profitability of the firm or the effort augmenting incentives of the exemption, would lend credence to the WTO interpretation.

Milazzo's fourth category, "cross-sectoral subsidies", is limited in his analysis to shipbuilding subsidies that are passed on to the fishing industry and infrastructure expenses. To the extent that shipbuilding subsidies are passed along as lower costs to fishermen, then they clearly are subsidies to the fishing industry. It is however, exceedingly difficult to evaluate the pass-through effect.

Milazzo's fifth category, "resource rent subsidies", is concerned with user fees and it is not clear that these are subsidies under the WTO agreement. Nonetheless, Milazzo quite correctly extended his analysis to include them.

Milazzo's sixth category, "conservation subsidies", programs intended to reduce fishing capacity and in general to enhance the resource base, were referred to by Milazzo as "good" subsidies. How these would fit into the WTO framework is unclear, although analogous "environmental" subsidies are non-actionable under conditions specified in Section 8.2 of the WTO Agreement on Subsidies and Countervailing Measures.

Milazzo's seminal work in fisheries subsidies is a major contribution to the literature, both in its attempt to estimate the magnitude of the world's fishery subsidies and for illustrating the breadth of subsidies and the difficulties encountered in defining and categorizing fishery subsidies. Milazzo generally works within the confines of the WTO definition of subsidies, but finds it too constraining or too vague, particularly when dealing with expenditures on infrastructure and with resource rent subsidies. He could profitably have gone even further and abandoned the WTO framework entirely. The key problem was that Milazzo was serving two masters: the constraints of the WTO and the role of subsidies as a stimulant to overfishing. As he stated in the letter to Dirlam referred to earlier, "sorting out these aspects of the issue is complicated and contentious." The result is that, even though Milazzo went far in comprehensively itemizing and evaluating subsidies, he could have gone further had he shed the cloak of the WTO.

Munro (1998) considered two aspects of Milazzo's discussion which are directly relevant to our question of finding an appropriate definition of subsidies. The first aspect rests upon the substantive role of subsidies in the fishery. According to Munro, the fundamental problem with fisheries arises from the perverse incentives that result from the ill-defined property rights that characterize fisheries. "If the definition of subsidies excludes foregone resource taxes", i.e. what Milazzo referred to as "resource rent subsidies" and which in all likelihood fall outside the WTO definition of subsidies, then Munro's answer to the question of whether "Milazzo's 'bad' subsidies" are the primary cause of the problem "is surely no." Contrariwise, a broader definition which includes resource rent subsidies renders subsidies a key determinant of the overexploitation problem in fisheries.

The second aspect of Milazzo's study that Munro critiqued was Milazzo's concept of a "good" subsidy. Munro argued that "good subsidies" are usually less benign than Milazzo suggested. Fundamentally, Munro's argument, which is developed at greater length in Gates *et al.* (1997), is that buyback and similar programs do not solve the fundamental problem but, instead, leave the perverse incentive system in place. Thus, buybacks will lead to re-overcapitalization for the same reason that there was overcapitalization in the first place. Moreover, these putatively good interventions may make a bad situation even worse, because, first, firms may overcapitalize in anticipation of a generous buyout and, second, if the bought out vessels are not destroyed, they may be deployed in other fisheries, creating overcapacity problems where none may have existed before. Arnason (1998) made a similar argument.

Wijkstrom (1998) compared the FAO subsidy figures with those of Milazzo, finding that Milazzo's were more comprehensive, including categories such as fees paid by one government to permit access to its fishing vessels to the waters controlled by another government, unrecovered costs of fishery management, and (presumably income) tax rebates. In addition, we note that Milazzo included resource rent subsidies. Since none of these "subsidies" directly enhance the firm's profit and loss accounts, they are implicitly excluded from the FAO computations.

V. THE DEFINITION OF SUBSIDIES

We have encountered great breadth in our survey of subsidies. The concepts range from the very narrow view of the United Nations in which subsidies are restricted to grants on current account to the very broad views of Hart, who includes massive infrastructure projects under the rubric of subsidies, and Gardner and Stanford, who also include labor legislation. They range from interpretations such as that of the WTO in which subsidies are seen as actions affecting international trade to those, such as that of Shoup, who consider subsidies primarily in a domestic context. They range from those who apply objective criteria to help define subsidies, as do Hart and Schrank and Keithly to those, including the WTO, who focus on "fairness" and those, including the *Oxford English Dictionary* and Shoup, who focus on "intent." They range from those

who view subsidies as being good (Mabawonku), to those who believe they are universally bad (Horemans, Hufbauer and Erb, and Munro), or either good or bad depending on the context (Milazzo and Schrank and Keithly). They range from those who believe that a subsidy must involve a financial cost to the government, as do the editors of the *Oxford English Dictionary*, the Joint Economic Committee, and Shoup, to those, including Stanford, who do not. Among all this disparity, there is one unifying theme. That theme, noted by Shoup, is that the transmission mechanism depends on manipulating relative prices, usually indirectly.

The reasons for the disparities are twofold. First, the definitions are often tainted by political considerations. Second, one's approach to subsidies is often intimately tied to the use to which the definition is to be put. These two reasons are not unrelated. If the objective concerns international trade, one can expect countries to act in what each sees as its own best interest, and clearly different countries, with different economic structures, will see their best interests differently. If, in addition, subsidies are something to be avoided, the countries will have their own ideas of what should be avoided and will define subsidies accordingly.

Perhaps the first source of confusion is that subsidies are often seen as "evil", something to be banned, or avoided. If one is seeking a generic definition of subsidies, this would be a poor place to start. What is judged to be good, or bad, is determined by one's objectives at a point in time and in a particular place. What may be perceived as bad in a failing fishery (as some in the United States and Canada) may be perceived good in a developing fishery (West Africa). Objectives and perceptions change over time and it seems unwise to base one's definition on such a shifting foundation. It would be better to have a stable definition and to evaluate as good or bad the concept in the particular context in which it is being judged. In the United States, following the passage and implementation of the original *Magnuson Act* of 1976, the policy of "Americanizing" the fishing fleet in United States waters,¹ and therefore of increasing domestic fishing capacity, was to be encouraged. Given the sustainability concerns of twenty years later, decreasing domestic fishing capacity was to be encouraged. One method of encouraging capital expansion in the United States was through income tax incentives (the Capital Construction Fund) and another was through loans on favorable terms (the Financial Obligation Guarantee program). Were these programs, which supported the expansionary policy of the day and were viewed favorably at the time, subsidies in the 1980s? Did they become subsidies only when these programs, still encouraging capacity increases, were continued (in one form or another) after the change in policy in the mid-1990s? Was the Capital Construction Fund (a tax deferral program), a subsidy since it cost the United States money in the form of lost or deferred taxes? Was the Financial Obligation Guarantee program, which had the same purpose as the Capital Construction Fund, not a subsidy because it was self-financing?

We seek an operational, generic concept useful for analysis and evaluation. It therefore would seem that to be a useful concept, subsidies should not be defined in subjective terms such as "good" and "bad," as was either explicit or implicit in the concepts used by Horemans and Hufbauer and Erb. Similarly, subsidies should not be defined by objectives, or by "intent." Thus, Shoup's definition, which relates to the government "seeking to accomplish its goal" or the dictionary's concern with "the furtherance of an undertaking" is either tautological, since it can be assumed that a government acts for a reason, and therefore the definition is functionally meaningless, or it adds a purely subjective component to the concept of subsidy. We desire a definition that does not rest upon a prior decision as to what is to be viewed favorably or unfavorably, or upon what was intended when a policy or program was adopted.

Another key issue in defining subsidies is the role of public finance. Gardner's list of agricultural subsidies included import controls, which, when implemented, have no effect on public finance other than management or transactions costs (there are no payments to farmers or others, nor are there tax waivers). Yet import controls constitute a government policy that has the effect of raising prices paid to farmers, and thus potentially increasing their profits, since potentially cheaper competing foreign products are eliminated from the market. The effect on the farmer is precisely the same as if the government did not restrict imports but paid a direct grant to farmers that permitted them to charge lower prices for their products. We have encountered no definitions of subsidies that would have excluded such direct grants. If import controls have

¹This emphasis is implicit in the italicized words in the previously cited passage from the *Magnuson Act*. See, *supra*, footnote 1 in page 14.

precisely the same effect as direct grants, then what operational purpose is served by labeling one as a subsidy and the other not?

If our concern were strictly with government finance, then perhaps the narrow definition, which would consider direct grants as subsidies but import controls as something else, would make sense. But this is not our interest. The FAO's discussions of fishery subsidies have clearly been motivated by an interest in conservation: overfishing, overcapitalization and overcapacity. The OECD is concerned how "economic assistance measures" affect the fishing industry. The WTO is concerned with impediments to trade. Milazzo's book focuses on trade and conservation. None of the agencies whose views we have noted, and none of the authors whose works we have reviewed, were concerned solely with public finance. Their concern was with the effects of the government policies which fall under the rubric of subsidies. This observation suggests that we should begin with the broadest concept of subsidy. Fishery subsidies are government policies that affect the fishery. Hufbauer and Erb, in their criticism of Malmgren *et al.*, took issue with precisely this approach. They objected that when subsidies are "an outright grant, interest-free loan, protection from imports, or is bestowed less visibly through tax exemptions...or relaxed health and safety or environmental regulations" the "definition would prove too sweeping for policy guidance."

We do not agree. Once the word subsidy is divorced from subjective connotations, the broadest definition provides the most useful starting point for analysis.¹ Fundamentally, a subsidy is any act of government that affects an industry, in our case, the fishery. The act may be directly applied to the industry, such as a direct payment by government towards the purchase price of fishing vessel or a regulation limiting catch quotas. Alternatively the act may be applied to an unrelated industry, such as government financial support for the purchase of agricultural fertilizer, where there may be indirect effects on the fishery, such as runoff which affects marine life. In an attempt to identify a concept covering a wide range of situations, and to place the idea on measurable footing, Schrank and Keithly narrowed it down so that the effect is on the profits of the industry, an approach not unrelated to Shoup's focus on relative prices.

It then remains to establish the relationship between our broad generic concept of subsidies and the economic application of concern, in this case, overfishing. Arnason (1998) and Munro (1998) provide formal analyses to demonstrate that cost reducing or revenue enhancing subsidies tend to increase fishing effort as, intuitively, one would expect. In the context of an open access fishery, they demonstrate that rents would be equally dissipated with or without the subsidy and therefore there is a futility to the exercise of subsidizing fisheries. They both, however, then ask why governments would subsidize the industry, concluding that the answer lies in the dynamics of the situation, that at least in the short run industry profits are enhanced. Munro credits this, in Canada at least, to the belief that the federal government, as manager of the resource, is responsible for the economic distress that results when fisheries fail. This is much too narrow a position, which hardly explains why fisheries subsidies, in one form or another, have been nearly universal, and why there were subsidies, as the introduction of fishermen's unemployment insurance in Canada in 1957, when fish stocks were healthy but the fishermen were poor. Munro does note, however, that "the first pre-requisite for subsidy programs" is factor immobility but that this condition alone would not be sufficient to generate subsidies.

Agricultural factors are similarly immobile and we have seen that agriculture is subject to a wide range of subsidization. Yet, over time, there has been a depopulation of rural communities, particularly in the American midwest and the Canadian prairies, while fishing communities appear to be more resilient. In both industries the fishermen and farmers have great political influence in their regions, which often feature only one major industry, and therefore adjustment can be expected to be slow as political pressure is applied to maintain communities through subsidies. The fishing industry, however, in these countries is much smaller than the agricultural industry and it is possible that the reason for the difference in government response is that it is cheaper and more affordable to maintain the fishing communities through various subsidy schemes than it is to maintain the agricultural communities, despite the short term political benefits of maintaining both. Whatever the root causes for the differences among industries, the political factor in the maintenance of fishing communities should not be underestimated.

¹Once the word is divorced from subjective connotations, there is no need for euphemisms, as in the OECD's use of "government financial transfers" or "assistance instruments".

Returning to the Schrank/Keithly approach, and to the question of the relationship of subsidies to overfishing, positive subsidies lead to anticipated increased profits in either the short, medium or long term. Thus, a boat bounty stimulates the building of fishing vessels; the owners anticipate profits to result. In an open access fishery, in the short term this result is likely to come to fruition, even though in the longer term overfishing will result and profits will decline. Equilibrium analysis shows correctly that no long term profits will result from the subsidy. Restricting the analysis to the equilibrium situation, however, conceals the short term motivation for the subsidy. Largely because of the sorry state today of many of the world's commercial fisheries, there has developed a general understanding of the ultimately futility of positive subsidies to the fishery. These are now usually seen as bad subsidies which should be abolished. Moreover, failure of governments to recover the costs of fishery management, or to charge resource rents for giving private parties the right to fish, also obviously make fishing more profitable and therefore stimulate entry or hinder factor mobility. These, too, are positive subsidies, although there is much less agreement on whether they should be eliminated. Munro believes that if the resource rent subsidy were eliminated, that is, if governments charged appropriate resource rents, the fishery problem would largely be solved. He is very likely correct.

Negative subsidies, contrariwise, are subsidies that tend to decrease production and encourage factor mobility. Whereas unemployment insurance is a positive subsidy, quota systems, effort restrictions and restrictive safety and environmental regulations are negative subsidies. Both Arnason and Munro argue that in a well managed fishery there is no need for buyback programs while in a poorly managed fishery they tend to be ineffective. Thus, while Milazzo considers such programs to be good subsidies, Arnason and Munro consider them to be neutral at best and more likely to be bad subsidies. It should be clear that the objective distinction made here between positive and negative subsidies implies nothing about the subjective view of a particular subsidy as being judged either good or bad. While Arnason sees little virtue in buyback programs, he is somewhat more sympathetic to pollution abatement subsidies since they reduce negative externalities.¹

Another application of the broad concept of subsidies to a problem of externalities concerns the use of turtle excluder devices on fishing gear. The basepoint is a situation in which the fishing technique incidentally kills turtles. Fishing is therefore generating a negative externality with respect to an environmental factor. Let us assume that the government then imposes a regulation requiring fishermen to use a turtle excluder device to counteract the externality. There are costs to the fishermen associated with the purchase and installation of the device, and the productivity of the fishing gear may be lowered as well. Thus, the regulation is a negative subsidy to the fishing firm; its profits are reduced. If the government then pays part of the initial cost of the device, the government is subsidizing its use and thus is a positive, cost reducing, or profit enhancing, subsidy. The net subsidy is the algebraic sum of the positive and negative subsidies, best estimated by determining the net effect on the firm's anticipated profits.²

The conclusions to be drawn from this discussion of the definition of subsidies are:

- (a) to avoid arbitrariness in deciding whether or not a particular government action (or inaction) is a subsidy, it is best to use a broad definition that envelopes even the broadest concepts (e.g., labor legislation) that we have encountered;
- (b) a government policy is a subsidy if it affects a firm's profits in the short-, medium- or long term;
- (c) subsidies can be positive or negative, depending upon whether they tend to increase or decrease the firm's profits;
- (d) whether a subsidy is positive or negative can vary with the length of the forecast horizon; and
- (e) there is no *prima facie* assumption that subsidies are undesirable; whether they are desirable (good) or undesirable (bad) depends upon the context and this in turn depends primarily upon society's goals at the time the evaluation is made.

¹We have seen that the OECD (Pearson, 1995) has taken a contrary view.

²This example is taken from Schrank and Keithly (1999, 159).

VI. THE SEARCH FOR CONSENSUS

A. Fisheries Subsidies: An Inclusive View

The various fishery subsidies we have encountered can loosely be categorized in the following way (with examples):¹

- a. direct government payments to or on behalf of the industry;
 1. grants to purchase new or old vessels, or to modernize vessels
 2. income support, unemployment insurance and income guarantee payments
 3. vessel decommissioning payments
 4. license, permit, and quota buyouts and retirement grants
 5. compensation for closed or reduced seasons
 6. compensation for damage to fish stocks
 7. government funded health programs specific to fisheries
 8. gear conflict compensation programs
 9. disaster relief payments to fishermen
 10. payments to foreign government to secure access to fishing grounds
 11. fishing-specific infrastructure
 12. equity infusions by government
 13. price support payments to fishermen
 14. grants to small fisheries and direct aid to participants in specific fisheries
 15. grants to establish international joint ventures
 16. grants for temporarily withdrawing fishing vessels
 17. vacation support payments
 18. payments to reduce accounting costs
 19. matching contributions for private sector investment
 20. transport subsidies
 21. support to improve economic efficiency
 22. provision of bait services
 23. grants for safety equipment
 24. gear development
- b. tax waivers and deferrals
 1. fuel tax exemptions for vessel fuel
 2. sales tax exemptions
 3. special income tax deductions for fishermen
 4. tax exemptions for deep-sea fisheries
 5. deferred tax programs
 6. investment tax credits.
- c. government fishery loans, loan guarantees and insurance;
 1. loans made on favorable terms (interest rate and amortization periods)
 2. government guarantees of bank loans
 3. fishermen's insurance programs or subsidized insurance
- d. implicit payments to, or charges against, the fisheries industry;
 1. market promotion programs
 2. hatchery and fish habitat programs
 3. free or below-market price resource access

¹These lists are based largely on those in [U.S.] Federal Fisheries... (1999, 37-43) and OECD (2000, 12). Those subsidies appearing under "d" which are positive subsidies are classified as "general services" by the OECD.

4. unrecovered costs of fishery management
5. input and output regulations
6. gear and vessel limitations
7. environmental regulations
8. technology transfer and government funded research and development
9. reduced charges by government agencies
10. sales of commodities to fishermen at less than market price
11. information collection, analysis and dissemination
12. promotion and development of fisheries
13. exploratory fishing and gear development
14. fisheries enhancement including support for artificial reefs
15. research on deep-sea fisheries
16. protection of marine areas
17. support for community based management, regional development bodies and producer organizations
18. retraining fishermen for other industries
19. enhancement of the fisheries community environment
20. international fisheries cooperation
21. market intervention
22. regional development programs
23. tariffs and tariff quotas
24. import quotas
25. price support systems
26. landing bans
27. prohibitions on foreign direct investment

c. general programs that affect fisheries;

1. subsidy programs for other industries which affect fisheries (e.g., agricultural, shipbuilding, general food promotion)
2. non-fishing specific infrastructure programs
3. general disaster relief and small business loan programs
4. labor legislation
5. social programs (national health systems, public education)
6. exchange rate regimes

B. Fishery Subsidies: Is Agreement Possible?

To what extent is international agreement possible concerning fisheries subsidies and where can we start looking for such agreement?

Starting with a broad definition, the importance of a subsidy cannot be divorced from the specific application under consideration. Let us assume that our interest in subsidies is not vaguely abstract but is anchored in a concern about the role of subsidies in either increasing or decreasing fish harvesting capacity. This is precisely the question that the United States Federal Fisheries Investment Task Force, authorized by the *Magnuson-Stevens Act of 1996*, was established to answer. Chapter VI of the report of the Task Force is concerned with the Capital Construction Fund (the CCF). Under the CCF program, fishermen can defer income tax on fishing profits by placing an amount up to their taxable income from fishing in an interest earning account that the fishermen agree will be used within a ten year period to construct or reconstruct fishing vessels. Nearly two billion dollars had been placed in the program from its start to 1995, and in that year there were fisheries CCF accounts with a total of \$242M outstanding. This is clearly a tax deferral scheme that has been popular with fishermen and has "influenced aggregate capital investments in the fisheries of the United States ([U.S.] Federal..., 1999, 63)." After reviewing the issues and listing a range of policy options, the majority of the Task Force concluded that contributions to CCFs should be limited and that, with the *Jones Act* exception to be described below, the funds should no longer be permitted to finance the construction or rebuilding of fishing vessels. Funds in the program could be redirected for alternative purposes, such as safety upgrades, training, research, buyouts, and quota purchases. The Task Force

recognized that the *Jones Act* in the United States, which requires that the construction and refurbishing of vessels participating in the United States coastal trade take place in the United States, is a positive subsidy to the shipbuilding industry and a negative subsidy to the fishing industry, since fishing vessels are included as well. By limiting competition, the *Jones Act* indirectly raises the cost of such vessels and therefore lowers fishing profits. To compensate fishermen for this loss, which occurs through no fault of theirs, the Task Force majority concluded that the CCF program should be modified to provide an offset to the *Jones Act* losses ([U.S.] Federal..., 1999, 67).

Since our concern is with how representatives of the international community will react to proposals for modifying or eliminating subsidies which tend to increase fishing capacity, it might be of interest to note how members of the Task Force, representing a minute microcosm of the world community, reacted to the majority opinion of the group. The report included five separate dissenting opinions whose signatories represented more than one-third of the Task Force members. Morgan ([U.S.] Federal..., 1999, 67-68) argued that the majority had neglected the fact that "a major advantage of the CCF program is that it allows boat owners to manage their resources in a way that partially compensates for the dramatic seasonal fluctuations in the industry." Vessel owners, through this subsidy, are able to absorb the income fluctuations characteristic of the industry. While other industries suffer volatility, the fishing industry is capital intensive, requiring large amounts of funds to be available for vessel replacement or reconstruction when necessary. Morgan concluded that the CCF program is beneficial because it allows boat owners to "set aside funds in good years for large capital improvements that may be required during bad years." In another dissent, Stevenson ([U.S.] Federal..., 1999, 67-68) argued that the fishing fleet is aging, noting that funds soon would be necessary for vessel replacement and that the CCF was useful for this purpose, although the "CCF should not be allowed to increase capacity in U.S. fisheries." Further, Stevenson stated, "an inherent advantage of this program is that it allows the industry to invest in its own future rather than be dependent upon or driven by outside forces such as its bankers." Blue ([U.S.] Federal..., 1999, 69-79), in the third dissent, supported Stevenson's position on the replacement of an aging fleet and noted in addition that there should be regional input concerning fishing capacity, presumably so that the CCF would allow an expansion of fishing capacity where fish resources are not being fully utilized. In the fourth dissent, Kendall ([U.S.] Federal..., 1999, 70) favored continuing the CCF program along its present lines because the aging fleet would soon require replacement. The current program, he believed, should continue to allow funds to be used for the present purposes but the range of uses should be expanded. In the final dissent, Woodworth ([U.S.] Federal..., 1999, 71) noted the diversity of United States fisheries. In particular, he emphasized that pelagic fisheries in Pacific islands under United States control are underdeveloped and the CCF program would be helpful in building the necessary fleets.

Our objective is not to evaluate the arguments raised in the Task Force report. It is merely to offer a concrete example of a fairly straightforward case of a positive subsidy that encourages increased capacity. Yet, when it came time to make a recommendation concerning the future of the subsidy program, dissenting arguments were made that the program should be continued to: (a) to help fishermen weather fluctuations, (b) to replace aging vessels, (c) to expand capacity in underdeveloped fisheries, and (d) to make the fishing industry independent of banks. Before agreement can be reached on the future of a subsidy program, there must be agreement on what problem is to be solved, on whether the problem is universal and, if not, what exceptions, if any, are to be tolerated. The subsidies problem must be placed in perspective, in a specific context, if the discussion is to be meaningful and if it is likely to result in favorable action. As was illustrated in this brief example, such discussions are liable to impinge on the discussants' public or private concerns and to be highly contentious.

Moreover, unless the term "subsidy" is simply to be banished, first there must be agreement that a subsidy is inherently neither good nor bad. Much of the difficulty in using the term, as the OECD seems to recognize through its use of euphemisms, lies in the negative connotations that the term exudes. Once that problem is solved, a broad definition should be adopted. We have seen that historically the term "subsidy" has had a myriad of meanings. All of these are subsumed in the concept of a subsidy being a government action that potentially affects a firm's profits. Although this version appears implicitly in the literature, as with Gardner, Hart or Stanford, it is normally not stated in this bald way. As with any new formulation, one expects to meet resistance. But if the emotive connotations have been removed from the word, the resistance could be diminished since, by accepting this definition, one is not yet committed to any action.

The next step in achieving consensus is the determination of what problem is to be solved. Presumably in the current case, the problem is excess capacity in fisheries. The appropriate action is to remove subsidies that encourage overfishing (positive subsidies) and encourage those that effectively discourage overfishing (negative subsidies). As we have seen in the brief review of the Task Force dissents, we can expect to hear arguments that overfishing and overcapacity are not universal and that there are underdeveloped fisheries. These arguments and others of a similar nature deny the necessity of universal action. The counter argument is that positive subsidies always tend to lead to overfishing and that it seems virtually impossible to cancel the subsidies before the damage is done. Technical economic analysis should be able to convince participants in the debate of which subsidies are positive and which are negative, i.e., of the effects of the various subsidies on fishing capacity. Getting agreement on which, if not all, of the positive subsidies should be abandoned and which negative subsidies should be adopted is the most difficult problem of all. It falls outside the realm of technical analysis and directly into the political arena. The situation is not helped by the concatenation of events described at the start of this paper. In particular, the inability to accurately predict fish populations together with the failure to monitor the economic state of fisheries make it more difficult to convince people whose income depends on the fishery, and their representatives, of the objective reality of the state of a fishery. Progress in these two areas can only help to solve the problems of subsidies.

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ESTIMATING FISHERIES SUBSIDIES AND THEIR IMPACT ON SUSTAINABILITY OF FISH RESOURCES: DEALING WITH DYNAMICS, RISK AND UNCERTAINTY

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INTRODUCTION

Under the FAO-sponsored International Plan of Action (IPOA) for the Management of Fishing Capacity, members agreed to assess the possible factors, including subsidies, contributing to the fisheries overcapacity problem. In a context of growing international awareness governments and industry are studying the influence of subsidies on international trade, on environment and on sustainable development. As pointed out by Milazzo (2000), the FAO accepted a responsibility to "collect all relevant information and data which might serve as a basis for further analysis aimed at identifying factors contributing to overcapacity such, inter alia, lack of input and output control, unsustainable fishery method, and subsidies which contribute to overcapacity".

This paper has the purpose of conducting a review of the published assessments of public sector subsidies to the fishery sector and of their impacts on sustainability of fishery resources. It has also the purpose to provide guidance for future studies of the impact of subsidies on sustainability of fish resources. It is organised in three major sections: (i) subsidies definitions and classifications, (ii) current international estimations of fisheries subsidies and financial transfers, and (iii) impact of cost reducing and income enhancing subsidies in the dynamics of resource biomass, fishery yield and resource rent.

It should be pointed out that some organisations present fishery subsidy taxonomies using a *government cost approach*. Other authors emphasise the need for estimating subsidies using the *change in profits approach*. The latter involve estimating the dynamic change in profits of resource users as a result of government action. This requires modelling resource dynamics and effort dynamics to estimate the inter-temporal impacts of subsidies on resource sustainability, fishery yield and profits.

SUBSIDIES: DEFINITIONS AND CLASSIFICATIONS

The definition of subsidy in the fisheries sector has been the subject of a number of international meetings and academic workshops aimed at setting the stage for a constructive discussion on their estimation and the corresponding impacts on sustainability of fishery resources.

Schrank and Keithly (1999, p.163) and the Federal Fisheries Investment Task Force, NOAA (1999, p36) in their Report to the U.S. Congress, provided a general definition of a subsidy: "Government action (or inaction) that modifies (by increasing or decreasing) the potential profits earned by the firm in the short, medium or long-run". More recently Schrank (2000) defines subsidy as being a *government action that potentially affects a firm's profit*. Schrank further suggests that the appropriate action is to remove subsidies that encourage overfishing (positive subsidies) and encourage those that effectively discourage overfishing (negative subsidies). He concludes that the inability to accurately predict fish populations together with the failure to monitor the economic state of fisheries makes it more difficult to convince people whose income depends on the fishery, and their representatives, of the objective reality of the state of the fishery. The estimation of fishery subsidy effects (biological, economic and social), in a context of uncertainty, will be discussed in the last sections of this paper.

Professor Schrank concentrates his paper in answering two basic questions related to the fisheries subsidies issue: (1) What definitions or definitions of subsidies are potentially most useful to governments and intergovernmental agencies in determining policies whose objective is the maintenance of the sustainability

of fish stocks? and (2) What definition or definitions of subsidies have the greatest potential for being accepted by the international community for the purpose of developing policies to encourage sustainability?

To answer this questions the paper discusses from basic dictionary definitions of subsidies to the ones agreed upon internationally (WTO/GATT context), or explored under domestic considerations (Shoup (1972), cited in Schrank (2000)) and sector specific applications (e.g. agriculture, fisheries).

For the international context, the paper acknowledges the WTO definition on subsidies as "any of the following acts of government, or more general a public body which confer a benefit:

- transferring, or potentially transferring, of funds, such as (i) grants, (ii) government loans or loan guarantees when they require smaller repayment than comparable commercial loans, (iii) government equity investment when the investment is inconsistent with standard investment practice
- Foregoing government revenue (tax exemptions or tax credits)
- Providing goods and services other than general infrastructure at less than market prices,
- Offering income or price supports

In a recent communication, the Government of New Zealand (2000) also identified a set of subsidy definitions in the fisheries sector, which can be summarised as follows:

Budgeted. It includes subsidies identifiable in government budgets, normally those of fisheries agencies, to assist fisheries in both domestic and foreign waters. This includes programmes for market price supports.

Unbudgeted. It includes subsidised lending and tax preferences.

Cross sectoral. It includes subsidies that indirectly benefit fisheries, such as subsidies to shipbuilding, and infrastructure subsidies such as expenses incurred in public works that benefit the fisheries sector

Resource rent. It includes expenditure related to research, resource management and enforcement action.

Conservation. This includes expenditures on programmes designed to enhance the fisheries resource base and foster "cleaner" harvesting technologies, such as vessel and permit buy-backs, stock enhancement, retraining of fishermen and research and development in clean harvesting gear.

Steenblik (1998) recognises that while economists may not agree amongst themselves on the precise definition of a subsidy, they do generally agree on their static, first-order effects. Theory shows that the effects depend on a number of factors, among which are supply and demand elasticities, the form of the subsidy, the conditions attached to it and how they interact with other policies. Steenblik further indicates that the beneficiaries of subsidies can become entrapped in a social sense as well. This is the case when subsidies are used to support employment in rural industries that require specialised skills but not necessarily formal education, such as in fisheries. The author states: "the resulting low mobility of the affected labour force itself becomes a barrier to reform, increasing subsidy dependency, and making structural adjustments all the more traumatic when it finally does come".

To properly put into context the role of subsidies on the current fully exploited or overexploited status of more than 69% of world fisheries (FAO, 1999), Steenblik and Munro (1999) identify as possible causes of overcapitalisation and over-exploitation of fish resources the following:

- (i) Lack of well defined property rights,
- (ii) Government financial transfers to the industry,
- (iii) Technical advances in fishing equipment.

To prevent subsidies from being provided to domestic fisheries it is fundamental to understand the rationale for their existence and allocation. Munro (1998) explains that the logic for subsidy programs and their motivation is that there be some degree of non-malleability of capital, both physical and human capital, with perhaps emphasis in the latter. In the case of international fisheries where management is usually non-existent, there is better possibility for explaining why subsidies are established. The rationale is that a fishing nation with capacity to exploit the resource will tend to subsidise its fleet to increase effort and shift some of the short-run dynamic resource rent from the competing State to itself.

Fleet subsidies fostering increases in fishing capacity for domestic as well as international fisheries can take different forms. Steenblik and Munro (1999) summarize these subsidy forms as follows:

- (a) Grants for the construction of new vessels
- (b) Grants for the modernisation of vessels
- (c) Preferential credit and tax treatment for (a) and (b)
- (d) Payment to foreign countries for access to fisheries
- (e) Reduced prices or tax breaks for purchased inputs (e.g. fuel, bait and ice)
- (f) Public expenditures on infrastructure and services used by the industry
- (g) Decommissioning fishing vessels, and
- (h) Market price support (i.e. transfer of money from consumers to producers resulting from policies that raise the price of fish or fish products)

It should be pointed out that a number of fishery subsidy taxonomies have been published recently which will be presented in the next section.

ONGOING INTERNATIONAL EFFORTS TO STUDY THE SUBSIDIES ISSUE

In a recent study on the impact on fisheries resource sustainability of government financial transfers, the OECD (Organisation for Economic Co-operation and Development) defines the concept of government financial transfer (GFT's), provides a classification of possible transfer to fishers that may affect their behaviour towards resource exploitation, and presents estimates for OECD member countries GFT's in the fisheries sector. The study focused on four major questions (OECD, 2000):

- What are the potential gains and costs involved in the transition to responsible fisheries?
- What are the impacts on fisheries resource sustainability of government financial transfers?
- What are the implications of post-harvesting policies and practices on responsible fishing?
- What are the social implications of moving towards more responsible fisheries?

A GFT is defined as the monetary value of government interventions associated with fisheries policies. Transfers are classified by OECD as (i) direct payments from government's budget to fishers, (ii) cost reducing transfers (i.e. fixed capital and variable inputs), and (iii) general services paid from governments budget to fisheries management and enforcement, research costs, stock enhancement, development of fishing ports, and free berthing at ports.

The European Union, the United States and Japan represent 83% of total OECD transfers from society to marine fisheries. Canada exhibits the highest ratio of direct payments plus cost reducing transfers over total landed value (16%). Total financial transfers for 1997 were estimated to be in the order US\$ 6.3 billion (Table 1).

Some of the main conclusions expressed in the OECD study include:

- i. Funding of fisheries research, management, enforcement and stock enhancement programs accounted for 77% of total GFT's in OECD countries.
- ii. Expenditures on research, management and enforcement activities are important requirements for ensuring sustainable use of fish stocks and the aquatic ecosystem.

- iii. Without adequate funding of research, fisheries managers could be faced with insufficient basic stock information, thereby increasing the risk of making the decisions that could adversely affect the health of the stock.

Table 1. Estimates of Government Financial Transfers to Marine Fisheries in OECD Countries in 1977 (Adapted from OECD, 2000).

OECD Member	(US\$ Million)						
	Direct Payments (DP)	Cost Reducing Transfers (CRT)	General Services (GS)	Total Transfers (TT)	Total Landed Value (TLV)	(DP+CRT)/TLV	TT/TLV
Australia	5	7	11	24	259	5%	9%
Canada	252	18	135	405	1621	17%	25%
European Union	366	358	710	1434	9324	8%	15%
Iceland	-	18	18	36	877	2%	4%
Japan	25	22	2899	2946	14117	0%	21%
Korea	30	59	253	342	4929	2%	7%
Mexico	-	-	17	17	1017	0%	1%
New Zealand	-	-	17	17	475	0%	4%
Norway	3	62	98	163	1343	5%	12%
Poland	-	-	8	8	215	0%	4%
Turkey	-	1	27	29	212	1%	13%
United States	21	194	662	877	3644	6%	24%
Total OECD	702	740	4856	6298	38032	4%	17%

Concerning calculations of worldwide subsidies, the most conservative estimate encounter concerning fisheries subsidies is in the order of \$US 14-20 billion per year (Milazzo, 1999).

WORLD TRADE ORGANISATION

The World Trade Organisation was established on January 1, 1995, replacing GATT. It has 133 members, 34 observer countries, 7 observer inter-governmental organisations among them FAO and OECD. Studies and discussions on subsidies have taken place within the Committee on Trade and Environment (CTE). The WTO Subsidies Agreement defines them in Article 1.1 (cited in Milazzo, 1999, p.10) as financial contributions in the form of: (i) transfer of funds (e.g. grants, loans equity infusions), (ii) potential transfers of funds (e.g. loan guarantees), (iii) forgone government revenue (e.g. tax preferences), (iv) goods or services (e.g. other than general infrastructure), (v) payment to a funding mechanism or to a private body to perform any of the above, (vi) price or income support programs other than tariffs.

Recently, the CTE issued a communication from the United States entitled Environmentally-Harmful and Trade-Distorting Subsidies in Fisheries in which the following issues are stressed:

- There is general agreement that overcapacity and overfishing are the common syndrome in most world fisheries
- It is generally agreed that subsidies that affect capacity or effort have effects on resource sustainability
- It is recognised that views differ concerning whether specific subsidies have positive or negative impacts
- Virtually everyone agrees that some subsidies have negative environmental effects because they tend to reinforce overfishing and overinvestment.
- These subsidies encourage overfishing and overcapacity because they are cost reducing (fixed and variable) or they enhance revenues and income or mitigate risks.
- The range of operation of the fleet receiving the subsidies will determine whether the environmental impact will affect one or more EEZ's.

Concerning this last item it should be pointed out that even if the fleets receiving the subsidies operate only within the specific country EEZ, negative externalities of international dimension may take place in cases where the targeted species is a transboundary resource.

The communication further suggest a taxonomy of 19 subsidies that reduce capital (fixed) and operating (variable) costs which could be summarised as follows:

Table 2. Cost reducing and income enhancing subsidies (Adapted from WTO, 2000)

Subsidy category	Cost reducing	Revenues enhancement
Government-funded commercially applicable research and development	Reduce information costs	
Government loans and loan refinancing below market rates	Reduce vessel investment costs	
Government loan guarantees	Reduce vessel investment costs	
Government forgiveness of government-funded loans	Reduce vessel investment costs	
Investment tax credits		Reduce income and sales tax
Income tax deferrals. Accelerated depreciation allowance		Reduce income and sales tax
Exemption of from national sales and fuel excise taxes	Reduce variable (fuel) costs	Reduce income and sales tax
Government supported marine insurance at below market rates	Reduce fixed costs	
Assistance to shipbuilding when benefits accrue specifically to fishers	Reduce investment costs	
Government funded foreign access payments	Reduce operating costs	
Government assistance to foreign fishery joint ventures	Reduce transactions (contractual) costs	
Government supported fishing vessel exports	Reduce variable costs	
Government supported below market risk insurance for foreign fishery investment	Reduce fixed costs	
Domestic price support programs		Increase revenues through State pricing
Government purchases for above market remunerations		Increase revenues through State pricing
Rebates of certain taxes on inputs if the finish product is exported	Reduce variable costs	
Government funded export subsidies		Income enhancement
Sector specific income maintenance programs		Income enhancement

PACIFIC ECONOMIC COOPERATION COUNCIL (PECC)

In August 1998, the Fisheries Task Force organised in Manila Philippines a Workshop on The Impact of Government Financial Transfer on Fisheries Management, Resource Sustainability and International Trade. The workshop begun by acknowledging that the impact of government financial transfers on fisheries is a controversial but highly relevant topic for discussion. During the workshop, Wijkstrom (1998) reviewed the attempts to measure subsidies in world fisheries, indicating that "while measures differ substantially, they all appear to indicate a downward trend in subsidies". The author pointed out that this is shown by recent empirical evidence in major fishing countries such as Russia, Norway and Peru where subsidies have been drastically reduced recently. He further stated that "three different surveys done by FAO all point in this same direction: a decline in the amount of subsidies provided". Wijkstrom (1998) also indicated that subsidies do not contribute automatically to resource depletion. The effects seem to be dependent to the extent to which fishing effort is controlled. In open access fisheries the negative effects of subsidies on resources could be eliminated either by their suppression or by ensuring strict effort limitations.

WORLD BANK

Milazzo (1999) presented a detailed study on world subsidies in fisheries which acknowledges the WTO definition of subsidies, and provides a classification of resource friendly subsidies because of their contribution to fishery sustainability. These are subsidies that:

- reduce exploitation effort
- divert producers from activities that promote overexploitation of resources to more benign economic endeavours
- are intended to enhance the resource base, and
- hasten the development of more environmentally sensitive harvesting technologies

Milazzo (1999) also presented six case studies for Japan, European Union, Norway, United States, Russia, and China, and extrapolated the estimations to provide a global projection of fisheries subsidies:

Table 3. Milazzo (1999, p.73) Estimates of Global Fisheries Subsidies (US\$ billions)

Subsidy category	Low	High
Budgeted subsidies:		
Domestic	3.0	3.5
Foreign access	0.5	1.0
Unbudgeted subsidies:	6.0	7.0
Subsidised lending		
Tax preferences		
Cross-sectoral subsidies:	1.5	2.0
Aid to shipbuilding		
Infrastructure		
Resource rent subsidies	3.0	7.0
Total	14.0	20.5

APEC

The Asia-Pacific Economic Co-operation forum was established in 1989. The purpose of this organisation is to advance Asia-Pacific economic dynamism and sense of community. Concerning overcapitalisation and overexploitation in fisheries, APEC is targeting at progressively removing all subsidies by 2003. This organisation is currently undertaking a study to identify subsidies in the fisheries sector.

OTHER INTERNATIONAL ORGANISATIONS

UNEP and WWF co-sponsored a workshop on "The role of trade policies in the fishing sector". As background for the workshop the WWF issued a document called "Subsidies and Depletion of World Fisheries". As part of this exercise a UNEP report by Porter (1998) indicates that subsidies contribute to fishing overcapacity in three ways: (i) by raising profits per unit of fish produced, subsidies attract more entrants into the fishing industry that would enter in an undistorted market, (ii) by reducing fishing costs and providing income support for fishermen and compensation for vessel owners when they are idle, subsidies encourage producers who would otherwise withdraw to remain in the industry, and (iii) by reducing the costs and risks of investing in more efficient fishing technologies, subsidies induce producers to adopt such technologies faster than would otherwise be the case.

The above review summarises previous efforts by OECD, WTO, PECC, and World Bank to define and estimate fisheries subsidies. Some have made explicit the different *government cost approaches* used for measuring the quantity of subsidies. Others, implicitly or explicitly consider in their taxonomy the *change in profits approach*.

It should be pointed out that for the purpose of sustainability of fish resources the relevant subsidy taxonomy is the one that explicitly estimates *cost reducing and revenues enhancing subsidies* affecting vessel profits directly or indirectly. Effort dynamics and consequently fishing capacity is highly dependent on vessel profits (Smith, 1969) and therefore subsidies accounting for resource sustainability purposes should tend to emphasize the *change in profits approach* rather than the *government cost approach*. Then, the next step is to deal with the dynamics, risk and uncertainty inherent in estimating the impact of cost reducing and revenues enhancing subsidies.

SUBSIDY EFFECTS ON SUSTAINABILITY OF FISHERIES: A DYNAMIC BIO-ECONOMIC IMPACT ANALYSIS

The analysis by Munro (1999, 2000), Arnasson (1999) and Asche (1999) among other scientists that attended the 1998 meeting on overcapacity, overcapitalisation and subsidies in European fisheries (Hatcher and Robinson, 1999) emphasise the need for estimating subsidies using the *change in profits approach* rather than *government cost approach*. The latter involve estimating the change in profits of resource users as a result of government action. The requires modelling resource dynamics and effort dynamics to estimate the impacts in biomass, yield and profits of alternative subsidies schemes.

The inter-temporal sustainable use and management of marine fisheries require systematic integration of the resource biology and ecology with the economic and social factors that determine resource and fishers' behaviour over time. The approach suggested for the development of intelligent management strategies for fisheries, including provision or elimination of subsidies, involves the following steps:

- (i) to identify the set of **management questions** related to the effect of existing or potential subsidies:
 - Case 1: Effect of cost saving subsidies: subsidies associated to fleet, inputs or yield
 - Case 2: Effect of revenue enhancing subsidies
 - Case 3: Effect of subsidies for technological development and adoption of species selective gear
 - Case 4: Effect of subsidies fostering technological development of habitat protecting gear
- (ii) to undertake **biological, economic and social assessment of the fishery**, i.e. estimate size and dynamics of the population structure, age structure of the harvest, costs and revenues of alternative fishing methods, contribution to food security, direct employment and export earnings,
- (iii) to select the **performance variables** for the fishery,
- (iv) to establish **limit and target reference points** for the selected performance variables,

- (v) to identify different states of nature for those fishery variables and parameters (i.e. recruitment seasonality, natural mortality, unit costs of effort, catchability coefficient, etc.) that involve high levels of uncertainty,
- (vi) determine if mathematical probabilities can be assigned for the occurrence of the identified states of nature,
- (vii) build decision tables with and/or without mathematical probabilities,
- (viii) apply different decision criteria reflecting different degrees of caution or risk aversion to select the management strategy involving introduction or elimination of subsidies,
- (ix) estimate the probabilities of exceeding the limit and target reference points of performance variables for the alternative management strategies under consideration,
- (x) re-evaluate periodically the fishery to establish new reference points and management strategies.

The use of *reference points* (Caddy and Mahon, 1995; Die and Caddy, 1997) as objectives for resource administration represents an important step in the management process. Also, the recognition of the uncertainty present in various parts of the fishery system is fundamental for a precautionary approach to the decision making process (Seijo and Caddy, 2000). To aid this process, the use of fisheries specific mathematical models allow researchers, managers and resource users to experiment with different management options concerning introduction or elimination of subsidies in order to estimate the possible dynamic consequences on different parts of the system and corresponding performance variables.

DEALING WITH RISK AND UNCERTAINTY WHEN ESTIMATING THE EFFECTS OF SUBSIDIES

Hilborn and Peterman (1996) among others have identified a set of sources of uncertainty associated to stock assessment and management procedures, including uncertainty in resource abundance, in model structure, in model parameters, on behaviour of resource users, in future environmental conditions, and in future economic, political and social conditions. To explore the effect of subsidies in resource sustainability and to deal with these variety of uncertainties using a precautionary approach, it was suggested, in the Lysekil meeting (FAO, 1995), the use of Bayesian and non-Bayesian decision theory (Francis, 1992; Defeo & Seijo 1999), and the incorporation of limit and target reference points to manage fisheries. Under this approach, decision-makers in fisheries are expected to select one management strategy, d , out of a set of D alternative strategies. When selecting a strategy involving subsidies, the fishery manager should be aware of the corresponding consequences. These consequences are likely to be a function of the cause-effect relationships specified in the fishery model, the estimated bio-economic parameters, and the possible states of nature (Seijo et al. 1998). There is a probability that a target reference point (i.e. resource biomass, yield, resource rent, direct employment, export earnings, contribution to food security in coastal areas, etc.) may not be achieved because of inherent randomness of natural systems, incomplete knowledge of the fishery system, changes in economic and biological/ecological exogenous variables (Garcia, 1996).

PROBABILITIES OF EXCEEDING LIMIT REFERENCE POINTS WITH AND WITHOUT SUBSIDIES

Given a probability density function with known parameters, Monte Carlo analysis allows introducing the uncertainty associated with natural variations and imperfect knowledge about the system being assessed when exploring the bioeconomic effect of subsidies. The process consists of an iterative calculation of the performance variables, where in each trial a new value for the unknown parameter is generated with the specified probability density function. Naturally, we will get as many outputs as trials to be intended. A very simple dynamic bio-economic model (Seijo and Caddy, 2000) is used to illustrate the process. Given initial conditions for resource biomass ($B_{t=0}$), and effort ($f_{t=0}$), the model main equations are the following:

Resource dynamics is calculated by integrating over the time horizon $[0, T]$ Schaefer (1954) biomass function.

$$B_{t+\Delta t} = B_t + \int_t^{t+\Delta t} (r \cdot B_t (1 - \frac{B_t}{K}) - Y_t) dt \quad (1)$$

where r is population intrinsic growth rate, and K is the corresponding carrying capacity. The harvest rate (Y_t) in time t is expressed by the following equation (Hilborn and Walters, 1992):

$$Y_t = B_t \cdot (1 - e^{-(q \cdot f_t)}) \quad (2)$$

where q is the catchability coefficient.

Fishing effort over time, f_t , is estimated by integrating Smith (1969) function as follows:

$$f_{t+\Delta t} = f_t + \int_t^{t+\Delta t} (\phi \cdot \pi_t) dt \quad (3)$$

where $\phi > 0$, the fleet dynamics parameter, and π_t , the corresponding profits, are calculated by:

$$\pi_t = \beta \cdot p \cdot Y_t - \alpha \cdot c \cdot f_t \quad (4)$$

Parameters p and c are the price of species and unit cost of effort respectively. Parameter α represents a cost reducing subsidy and parameter β a revenues enhancing one. Values of bio-economic parameters for this simple simulation are presented in Table 4.

Table 4. Bio-economic parameters for dynamic fishery analysis with and without subsidies

Parameter	Description	Unit of measurement
$r = 0.36$	Intrinsic growth rate	year ⁻¹
$K = 3500000$	Carrying capacity of the system	Tonne
$q = 0.0004$	Catchability coefficient	---
$p = 60$	Price of species	US\$
$c = 30000$	Unit cost of effort	US\$/ue
$\phi = 0.000005$	Fleet dynamics parameter	---
$\alpha = 0.80$	Cost reducing subsidy	---
$\beta = 1.15$	Revenues enhancing subsidy	---

To represent specific complexities dealing with age structure of the population, multi-species and multi-gear situations, appropriate dynamic models should be used to represent such relevant factors of the fishery system (Seijo *et al.* 1998).

For this simple illustration, Figure 1 shows the dynamic trajectory of biomass, yield and resource rent with and without alternative subsidies schemes: cost reducing (cs) and revenues enhancing (rs).

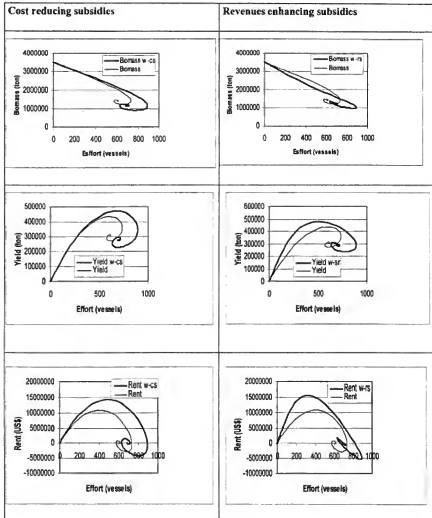
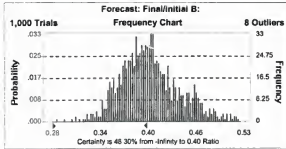
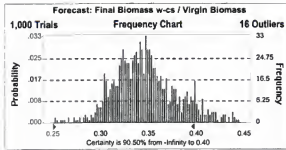


Figure 1. Dynamic trajectory of resource biomass, fishery yield and resource rent under an open access regime with and without two alternative subsidies schemes

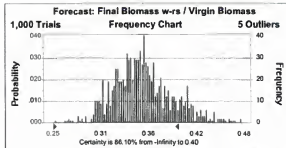
With these two types of subsidies, the probability of exceeding the limit reference point for current over initial biomass ratio ($B_t/B_0 = 0.4$) with an open access management strategy with and without subsidies is illustrated in Figure 2.



(a) Risk of exceeding LRP under open access without subsidies



(b) Risk of exceeding LRP under open access with cost reducing subsidies



(c) Risk of exceeding LRP under open access with revenues enhancing subsidies

Figure 2. Probability of exceeding a limit reference point for current over initial biomass ratio with and without subsidies in an open access regime.

With X axis representing the variable observed (e.g. biomass), and Y axis the probability of occurrence for each X's value. The area below the curve at the left of the limit reference point ($B/B_0 = 0.4$) corresponds to the probability of an undesirable event occurring in the fishery (e.i. certainty of 86.1 % that the B/B_0 ratio will be, under an open access regime with revenues enhancing subsidies, below the limit reference point), whereas the area below the curve at the right of this point indicates the probability of achieving desirable levels for the biomass indicator. In this hypothetical case, the intrinsic growth rate was randomly generated with a normal probability density function and Monte Carlo runs of a simple dynamic Schaefer-Gordon model with fleet dynamics built in produced the corresponding probability distributions in relevant performance variables such as biomass, yield and resource rent. It should be pointed out that the probability density function to be selected for the Monte Carlo analysis should be the one that best fit the observations of the random variable to be generated with the corresponding variance.

For this purpose, in addition of current open access (D_1) two other alternative management strategies are considered:

D_2 : authorising 450 vessel licences (effort at maximum sustainable yield, f_{MSY}) and,

D_3 : authorising 289 vessel licences (effort at maximum economic yield, f_{MEY}).

This simple case illustrates the incorporation of uncertainty in selected bio-economic indicators of fisheries (e.g. current over virgin biomass ratio, and rent over MEY) for three alternative management decisions with and without subsidies. With management decision D_2 , the probabilities of exceeding the biological and economic limit reference points are substantially reduced. With decision D_3 the risk is eliminated (Tables 5 and 6).

Table 5. Probabilities of exceeding biological Limit Reference Points ($LRP=0.4 \cdot B_0$) with and without subsidies subject to alternative effort control strategies.

Management Strategy	Effort without Subsidies (vessels)	Probability of exceeding LRP	Effort with cost reducing subsidy (vessels)	Probability of exceeding LRP	Effort with revenue enhancing subsidy (vessels)	Probability of exceeding LRP
Open access (Effort at bio-economic equilibrium)	578	0.44	627	0.91	620	0.86
Limited access at f_{MSY}	450	0.09	450	0.12	450	0.13
Limited access at f_{MEY}	289	0.00	313	0.00	310	0.00

Table 6. Probabilities of exceeding an economic Limit Reference Point ($LRP=0.4 \cdot f_{MEY}$) with and without subsidies subject to alternative effort control strategies.

Management Strategy	Effort without Subsidies (vessels)	Probability of exceeding LRP	Effort with cost reducing subsidy (vessels)	Probability of exceeding LRP	Effort with revenue enhancing subsidy (vessels)	Probability of exceeding LRP
Open access (Effort at bio-economic equilibrium)	578	1.0	627	1.0	620	1.0
Limited access at f_{MSY}	450	0.29	450	0.16	450	0.15
Limited access at f_{MEY}	289	0.00	313	0.00	310	0.00

Tables 5 and 6 demonstrate Wijkstrom (1998) assertion that subsidies do not contribute automatically to resource depletion. The effects seem to be dependent to the extent to which fishing effort is controlled. In open access fisheries the negative effects of subsidies on resources could be eliminated either by their suppression or by ensuring strict effort limitations. This implies that in situations where it is not socially or politically feasible to eliminate subsidies in the short-run, enforcing effort limitations at appropriate levels (f_{MSY} or f_{MEY}) may substantially reduce or even cancel the risk of exceeding biologic and economic limit reference points.

CONCLUDING REMARKS

Some of the main conclusions that can be derived from reviewing recent international efforts to study the subsidies issue and its relevance to fishery resource sustainability include the recognition that: (i) there is a wide diversity of subsidy taxonomies involving government financial transfers to fisheries, (ii) estimates of these transfers are in the range of US\$ 14 to 20 billion annually, (iii) funding of fisheries research, management, enforcement and stock enhancement programs accounts for 77% of total government financial transfers in OECD countries, (iv) expenditures on research, management and enforcement activities are important requirements for ensuring sustainable use of fish stocks and the aquatic ecosystem, (v) without adequate funding of research, fisheries managers could be faced with insufficient basic stock information, thereby increasing the risk of making the decisions that could adversely affect the health of the stock, (vi) there is general agreement that overcapacity and overfishing are the common syndrome in the majority world fisheries, (vii) in the absence of effort limitations, it is generally agreed that subsidies that affect capacity or effort have effects on resource sustainability, and (viii) it is recognised that views differ concerning whether specific subsidies have positive or negative impacts (e.g. subsidies inherent in buyback programs).

To estimate the impact of subsidies on sustainability of fish resources, the analyst needs to deal with the inherent dynamics, risk and uncertainty present in marine fisheries. Results of the illustration indicate that, under open access conditions, cost reducing and revenues enhancing subsidies encourage overfishing and overcapacity and may involve high probabilities of exceeding fishery specific biologic and economic limit reference points.

Future studies of subsidy effects on fishery sustainability should also explore the potential effect of subsidies for technological development and adoption of size and species selective gear, subsidies for designing and adopting habitat protecting gear, subsidies fostering recruitment enhancement technologies, and subsidies that foster friendly use of critical coastal ecosystems (e.g. wetlands, mangroves, estuaries, coastal lagoons, wetlands and sea grass beds) which are relevant to fisheries.

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A REVIEW OF PUBLISHED ESTIMATES OF PUBLIC SECTOR SUBSIDIES TO THE FISHERY SECTOR AND THEIR IMPACT ON TRADE IN FISH AND FISH PRODUCTS

by

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OVERVIEW

Fish, shellfish and fishery products are widely traded. In 1996 the export sector earned US\$52.5 b. No less than 195 countries export part of their production and about 180 countries import fishery products. The economic importance of fisheries is underscored by the number of economies that derive a significant share of their export earnings from trade in seafood products, especially the economies of developing countries. In 1996 developing economies achieved a net trade surplus of US\$16.6 b. International trade in fishery products is also of importance to developed economies who import about 75 percent of internationally traded fish products. The relative efficiency of the mechanisms underpinning the production, processing and trade in fish and fish products is therefore of great importance.

SUBSIDIES AND FISH TRADE

Against this background of production and trade, the issue of fisheries subsidies has recently attracted a great deal of interest at the international level. While there appears to be little dispute over stock depletion in certain species and the fact that the current level of effort is not sustainable, the cause remains contentious. Concern over the use of fisheries subsidies has spilled over into the arena of international trade. Many country submissions to the World Trade Organization (WTO) claim subsidies are the cause of inefficient resource allocation, resource depletion and trade distortions. Others advance the view that subsidies are only one of the factors distorting the fisheries sector. The Milazzo (1998) study is frequently used to establish a linkage between over-capacity and excessive effort, and adverse environmental outcomes. However, at this point in time, the linkage between subsidies and trade patterns is not based on research and remains conjectural.

From a theoretical perspective, a good selection of static and dynamic models is available to study the economics of fisheries management and policy. These models have proven their utility by assisting economists and policy analysts to focus on issues related to subsidies and capacity, subsidies and sustainability. Theoretical models of renewable resources and international trade models are not as well developed as the models used to study fisheries management and policy. However, it would be relatively easy to extend renewable resource and international trade models to include subsidies and trade.

Empirical work on the linkages between subsidies and fish trade should begin with a logical, comprehensive and transparent definition of subsidy. Schrank's (2000) definition of subsidy spans those used in the literature. When interpreting estimates of fisheries subsidies it is important to recognize differences and omissions. For example, Milazzo's study only included subsidies to the harvesting sector; processing was omitted.

At the time of the review, Milazzo's (1998) estimate of subsidies was the most comprehensive although it too is limited to the extent that six economies (significant in their share of the world fish harvest) were studied. Milazzo's definition of subsidy fits within that provided by Schrank (2000) and the report provides a wide-ranging estimate. The results obtained for the six economies were aggregated up – using estimated world revenue – to provide an annual global estimate of between US\$14.0 billion and US\$20.5 billion.

The more recent OECD (2000) report is based on a sample obtained from eight out of twenty-five economies. Total government financial transfers in OECD countries was estimated at US\$6.3 b, which is equivalent to 17 percent of the landed value of marine capture fishery products. Expenditures on direct payments and cost reducing transfers are equivalent to 4 percent of the landed value of fishery products. The OECD report shows a wide range of transfers across OECD countries. The total value of transfers – expressed as a percentage of landings – ranges from 1 to 90 percent. Eight countries transfer funds valued in excess of 20 percent of the value of total landings. Four countries transfer less than 5 percent. The report acknowledges that the estimate is probably too low because it does not include significant support items for some countries such as market price support, tax concessions, non-payment of fishing port berthing fees, support to builders of fishing vessels and regional and local government expenditures.

Neither the Milazzo nor the OECD study attempted to estimate the impact of subsidies on trade. Although the impact of fisheries subsidies on international trade flows is a recurring question (as is the link between capacity and sustainability) current empirical knowledge is very limited. This shortcoming is widely acknowledged.

METHODOLOGIES FOR MEASURING IMPACT ON TRADE

The review of published estimates of public sector subsidies reveals two predominant methodologies. First, measures based on a sample of government budget data provide reasonably robust estimates of direct expenditures. Extrapolating these results to arrive at global estimates is illuminating and may provide an indication of the global subsidy involved. No statistical confidence intervals attach to global estimates. Second, the case study approach has been used to examine a wide range of topics related to subsidies, capacity and sustainability. While this approach is informative and provides good institutional detail it remains idiosyncratic and descriptive.

In summary the following methods have been used:

- Government budget studies: common to the reports of Milazzo (1998) and OECD (2000).
- Inference: common in the analysis of specific agreements and in situations where data are lacking. Implicit subsidies associated with access agreements and resource conservation were estimated by inference.
- Econometric estimation: potentially a very powerful tool but very limited use to date. The exception is Campbell *et al.* (1994) although they did not explicitly examine subsidies and trade in fish products.
- Mathematical modeling: another potentially powerful tool but limited use to date. Theoretical models have been successfully used to highlight the linkages between subsidies and capacity and sustainable fisheries management. Recent uses of computable general equilibrium models provide useful insights into the relationship between trade reform, impacts on the domestic economy, and trade patterns.

CONCLUSIONS

Good descriptive information about subsidies exists and qualitative linkages between these and resource sustainability and trade have been explored. Quantitative estimates of government transfers are available. When developing empirical estimates of the economic impact of subsidies on trade it is essential that aggregate measures identify and control for differences in government policies. Aside from the studies that use government expenditure programs to estimate subsidies, there are no published attempts at dealing with the methodological issues of quantifying distortions in seafood trade. The published literature (see for example, Schwartz and Parker, 1988) on measuring government interventions in agriculture could provide a useful starting point. The application of economic models to the problem of measuring the quantity of subsidies and their impact on trade in fish and fish products is limited.

RECOMMENDATIONS

A coordinated three-pronged research program would contribute to filling the knowledge gap:

- The application of dynamic models to fisheries subsidies and trade would strengthen the theoretical underpinnings of applied research.
- Locating subsidies and trade within the context of applied general equilibrium analysis would highlight linkages between government policy, economic performance and trade flows. Applied modeling could usefully adapt GTAP (see Chapter 2) to run simulations on perturbations to world subsidy regimes and trace out the general equilibrium impacts.
- Applied econometric analysis linking economic variables with observed trade flows would provide more concrete evidence of the impact of subsidies.

Much remains to be done.

1. INTRODUCTION

FAO first looked into fishery subsidies in 1960. However its most publicized work on subsidies was a "Special Chapter" to the 1992 edition of *The State of Food and Agriculture*. That Chapter, prepared with the assistance of Francis Christy, estimated a US\$54 b. annual shortfall between fishing revenues and costs, and by inference, concluded that government transfers must have covered most of the deficit. Subsidies were seen to distort trade patterns, affect prices and distort sources of supply. Removing subsidies would thus provide a double dividend for both the environment and the global economy.

The FAO Committee on Fisheries (COFI) was established in 1965. In 1998, at the 25th Session of COFI, delegates discussed the issues related to fisheries management, subsidies and international trade. The report of the 25th Session of COFI records discussion where many delegations stressed that the use of subsidies could aggravate over-exploitation of resources and distort trade. However, other delegations considered subsidies might be necessary, for example, to secure employment and food security. One delegation stressed that there was no direct link between the question of over capacity and distortion of trade in the fisheries sector (WTO, 2000b).

The relationship between subsidies, trade and sustainable fisheries has been studied by a number of international organizations. The OECD has been working on issues relating to fishery subsidies since 1965 (Steenbilk and Munro, 1999). The OECD Fisheries Committee's latest report on government support to the fishing industry is reviewed below. The WTO, through the Committee on Trade and Environment (CTE), has also considered fisheries subsidies. The United Nations Environmental Program (UNEP) co-sponsored with the World Wildlife Fund (WWF) a Workshop on the Role of Trade Policies in the Fishing Sector. Finally, the much-referenced World Bank study on subsidies in the World Fisheries, by Milazzo (1998) provided further estimates of subsidies.

New Zealand and Japan are co-sponsoring an APEC study into the Nature and Extent of Subsidies in the Fisheries Sector of APEC Member economies. The purpose of this study is to identify subsidies used in the fisheries sectors of APEC economies and to identify how the Subsidies and Countervailing Measures Agreement applies to these subsidies. The results of this study were not available.

1.1 Purpose of this Review

The purpose of this study is to:

- establish what is reported in published documents/studies about the impact of subsidies to the fishing industry¹ on trade of fish and fish products;
- assess the methodologies used (i) in measuring the amount of subsidy and (ii) in assessing the magnitude of its effects on trade in fish and fish products; and
- provide guidance for future studies on the impact on trade in fish and fish products of subsidies to the fishing industry.

1.2 Approach

A reasonably comprehensive literature search was completed. Many published reports were available at FAO. Additional reports and academic papers were obtained from the university libraries in New Zealand. Correspondence with academics and New Zealand trade officials suggests that the literature review is comprehensive. The literature search located a number of reports appearing in industry publications that could not be obtained within the timeframe.

For each published document, the report provides:

¹ The fishing industry is taken to include capture fisheries and aquaculture, harvesting and processing activities.

- a brief summary of the impact of subsidies provided to the fisheries sector on the trade in fish and fish products; and,
- a brief review and appraisal of the methodologies used in measuring the quantity of subsidies and in measuring/estimating the impact of subsidies on trade in fish and fish products.

The review uses Schrank's definition of subsidies (see FI:EIRF/2000/Inf.3).

A summary of the results is provided in the Overview, including:

- a summary of typical effects on trade in fish and fish products that can be associated with the various types of subsidies provided to the fishing industry;
- an appraisal of the suitability of the various methods used for measuring (i) the quantity of the subsidies, and (ii) their impact on trade in fish and fish products;
- an assessment of which types of subsidies seem to be most urgent for future studies, considering their likely magnitude and impacts.

1.3 Report Outline

The report begins with an Overview and list of recommendations. Chapter 2 provides an overview of economic models that have been used to study issues related to subsidies. These models provide the conceptual basis for empirical analysis. Chapter 2 also provides a summary of the approaches suggested for measuring the impact of subsidies on trade. Summaries of the published literature are presented in Chapter 3. The literature on subsidies and trade typically spans a number of dimensions viz. subsidies, sustainability, governance and trade flows. It will become evident that few published studies emphasise the subsidies-trade nexus, most deal with subsidies, capacity, and sustainability.

2. MEASUREMENT OF SUBSIDIES AND THEIR EFFECTS ON TRADE

A brief overview of the basic models used in fisheries economics and trade is provided below. The purpose of the overview is twofold. First, have adequate economic models been developed to study the problem? In the tradition of fisheries economics, even a simple model can yield powerful insights into fisheries management and policy. Second, economic models provide a basis for organizing the collection of data and deriving testable hypotheses. The intellectual roots of the economics of fisheries management go back to the early work of Gordon (1954). Others, such as Scott (1955), Clark and Munro (1975), and Arnason (1991), have enhanced the basic Gordon model to examine a range of economic issues, including management regimes, capital investment, tradable rights and more recently the issue of subsidies.

2.1 Economic Models of Subsidies

The impact of subsidies on fishing effort and biomass is illustrated using the simple fisheries model.

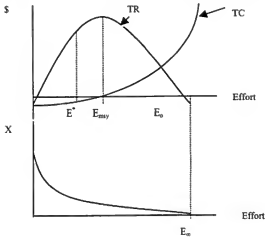


Figure 2.1: The Simple Fisheries Model

Three functions are shown in Figure 2.1. The exact nature of these relationships is an empirical issue.

1. Total revenue (TR) is shown to increase as fishing effort (E) increases up to a point at which sustainable harvest is at a maximum (E_{my}). Increasing effort beyond E_{my} reduces revenue and the biomass X until the fishery collapses at E_o .
2. Total cost (TC) increases with effort.
3. The fishery biomass X falls with increasing effort.

The outcomes associated with two alternative systems of management - "open-access" and "sole ownership" - are illustrated in Figure 2.1. In the absence of any form of management control, the so-called bionomic equilibrium occurs at E_o - where total revenue equals total cost. At E_o there are no net profits in the fishery. In a competitive environment this is the point at which open-access fisheries operate. Competition erodes net profit in the fishery. In contrast, net profits are maximized at E^* - the equilibrium under "sole ownership".

The model provides a basis for examining the impact of two broad classes of subsidy

(i) subsidies that lower the cost of effort and (ii) subsidies that increase revenue. Both subsidies fall within the definition provided by Schrank (2000). Two testable hypotheses follow:

1. government policy that lowers the cost of harvest will *ceteris paribus* result in an increase in effort, and
2. government policy that raises unit revenue above the market price will *ceteris paribus* result in an increase in effort.

Subsidies therefore increase effort beyond the efficient level of effort E^* and reduce the stock of biomass. The economic impact of subsidies is amplified when subsidies co-exist with an "open access" regime.

Aranson (1999) provides a dynamic fisheries model that sheds further light on the basic problem of fisheries subsidies and over-capacity. The results of a numerical example show how subsidies make a bad (i.e. competitively managed fishery) situation worse. The subsidization rate used in the example is within the bounds of Milazzo's (1998) estimate of 20 percent of total revenue. To this, must be added the cost of

administering the subsidy scheme and loss of consumer surplus resulting from a reduction in fish supply. Turning to dynamics, the time path of fishery rents (and therefore net present value) in an unsubsidized fishery are shown to exceed those in a subsidized fishery.

Table 2.1: Static Equilibrium Outcomes

Variable	Optimal	Competitive No subsidy	Competitive Subsidy
Effort	0.34	1.00	1.08
Harvest	76.6	92.6	82.6
Industry profits	44.7	0	0
Subsidy	0	0	17.7
Social profits	44.7	0	-17.7

Source: Arnason (1999)

Chichilnisky (1996) uses a similar dynamic model to show that the long-run supply curve for the open-access regime lies below the long-run supply curve of the private property rights regime. The steady state quantity harvested under open-access is larger than that harvested under private property. Thus the long-run steady state of the resource is smaller under open-access. The supply of the resource depends on, and is shown to be increasing in, relative prices.

The impact of subsidies on trade – assuming a small country case – is shown in Figure 2.2. If a subsidy equal to s (per unit) is paid to fishers, their supply shifts from S to S' because the subsidy reduces the average and marginal cost of production, and production will expand out to OQ_2 . If the price of fish remains at P_w , consumers continue to purchase OQ_4 and imports fall to Q_2Q_4 . The subsidy to domestic producers is included in government expenditures (Milazzo, 1998; OECD, 2000) and is a transfer payment from the rest of the economy. The cost to government (taxpayers) is $S(a+b)$ of which Sa is a transfer and Sb is a deadweight loss.

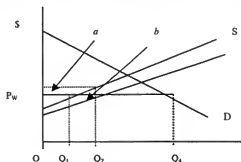


Figure 2.2: The Partial Equilibrium Effect of a Subsidy, Small-Country Case

Brander and Taylor (1997) provide an early contribution to the theory of international trade and open-access renewable resources. They show that when one or both trading partners manage the resource, both countries may gain from trade. Emami and Johnston (2000) build on the work of Brander and Taylor and examine the effects of free trade in a renewable resource between two countries in the presence of incomplete property rights. The model used is a simplified general equilibrium steady-state model. They demonstrate that resource management by only one of the partners may reduce the welfare for both when compared to the case in which neither manages its resource sector. In the presence of weak (i.e. attenuated) property rights, the consequences of renewable resource management policies depend on model parameter values and circumstances. In other words, generalizations are difficult to make and empirical work is required to predict the results of particular governance structures.

2.2 From Economic Theory to Measurement

Developing a measure of the economic impact of subsidies on trade poses two problems (Schwartz and Parker, 1988). One is that a number of government policies may affect fish products. This calls for an aggregate measure. Second, it must be decided how government intervention is measured because government policies can influence a number of different economic variables. The following measures have been proposed for examining the impact of subsidies on fisheries trade. Few have been applied (see for example, Faehn and Grunfield, 1999).

Subsidy equivalent measures

A subsidy equivalent is defined as the single monetary value needed to compensate the recipient of benefits of policy interventions for the removal of the particular interventions of interest. A producer subsidy equivalent (PSE) is defined as the level of subsidy needed to compensate producers for the removal of existing government support. PSE was first used at FAO (1975) by Josling. Later, both the WTO and OECD used PSE in their work on measuring transfers. Accepted conventions for calculating PSE do not exist, several versions have been estimated, each differing according to policy coverage (Shwartz and Parker, 1988). If $PSE > 0$ then the taxpayer/consumer is paying the subsidy. A negative PSE means that the government is directly or indirectly taxing the producer. The WTO concept of aggregate measure of support (AMS), which it uses to monitor progress in achieving commitments made in the Agreement on Agriculture, is loosely based on PSE. The concept of consumer subsidy equivalent (CSE) is analogous to PSE as the subsidy needed to compensate consumers for the removal of specific policies. The PSE measure has never been fully applied in the OECD Fisheries Committee. The controversial parts include estimating subsidies to inputs such as vessel construction and infrastructure.

When calculating PSE, four groups of measures are taken into account:

- market price support which cause change in market prices
- direct income support
- programs that lower producer costs
- other programs that reduce costs.

Therefore, in summary form:

$$PSE = (\text{price received by the domestic producer} - \text{less world price} + \text{government subsidy} - \text{less input price markups}) / \text{world price}$$

This definition of PSE would quantify some subsidy policies but not all. For example, governance (e.g. rules defining access to fisheries) is not explicitly considered. While the method can be applied in principle, product variation in the fishing industry could result in tedious computational exercises because of the numerous species-product combinations that exist.

To address Schrank's (2000) definition of subsidy, a modified PSE would have to include:

- measures providing market price support: that affect both producer and consumer prices, and include limits on landings from foreign vessels, increased costs and/or loss in value arising from double shipment;
- direct income support, including unemployment compensation;
- indirect income support e.g. quota or license subsidy (QLS), subsidies on inputs;
- other support measures that lower the cost in the long term e.g. infrastructure.

One measure that is problematical is the notion of QLS. The logic behind QLS goes as follows: returning to Figure 2.1, economic rent r in the fishery is maximized at E' , when marginal cost equals marginal revenue. If m licenses are allocated, n to the national fleet and f to foreign vessels, then the theoretical value of a license is r/m . Thus $QLS = r/m$. Case studies reported below will provide examples of how some distant water fleets enjoy a subsidy through relatively low access fees (see for example, Porter, 1997).

Effective rate of assistance

The effective rate of assistance (ERA) is an extension of PSE that takes into account the effects of government policies on the costs of inputs to the sector. ERA is defined as the percentage difference between the value added per unit of output with and without assistance. The measure takes account of the direct effect on the price of intermediate inputs and adding factors (e.g. capital) and the direct effect on prices of intermediate inputs of protection to industries producing inputs.

Trade equivalent output subsidy (TEOS)

The trade equivalent output subsidy (TEOS) is a model-based measure of trade distortion. The efficient allocation provides a benchmark against which the amount of trade distortion can be measured. In the case of fishing, this may be difficult to measure because:

- an efficient allocation cannot be obtained without government intervention;
- restrictions on the free movement of vessels to national fishing grounds constitutes a distortion; and
- the difficulty of developing a model of the industry because of the complex nature of the production function.

The TEOS expresses the output subsidy that, in the hypothetical situation, where all other government intervention, other than that needed to assure an efficient allocation, is removed, will maintain the country's net export of the commodity in question at its actual level. This measure was proposed by the EC Commission as the subsidy to the fishing industry which, assuming that the fishery is efficiently managed, would be needed in the absence of any government intervention for the net export of fish products to be identical to the current net export. As a benchmark to calculate the TEOS, a situation is envisaged where fisheries are managed using individual transferable quotas (ITQs). An optimization - partial or general equilibrium - model is necessary to estimate TEOS.

2.3 Summary

A good selection of static and dynamic models is available to study the economics of fisheries management and policy. These models have proven their utility by assisting economists and policy analysts to focus on issues related to subsidies and capacity, subsidies and sustainability. Renewable resource trade models are not as well developed.

Aside from the studies that use government expenditure programs to estimate subsidies, there are no published attempts at dealing with the methodological issues of quantifying distortions in seafood trade. The published literature on measuring government interventions in agriculture (Schwartz and Parker, 1988) could provide a useful starting point.

3. PRESENT KNOWLEDGE ABOUT THE IMPACT OF SUBSIDIES ON TRADE

Since the mid-1990s several major international organizations have taken an active interest in the question of subsidies in fisheries. The origins of this increasing focus on subsidies can be traced back to the Special Chapter in the FAO publication "State of Food and Agriculture". The initial direction of this work was on examining subsidies as a measure of conferring unfair trade advantage. But, as this Chapter will demonstrate, the linkage between subsidies and trade has not been systematically studied nor have trade distortions been quantified.

The emphasis in international trade theory has been on comparative static analysis of, for example, the qualitative or quantitative, effect of a tariff, quota or subsidy. A partial equilibrium model of subsidies, as described in Chapter 2, can be of assistance in quantifying subsidies and estimating deadweight loss. Thus the Milazzo (1998) and OECD (2000) study can, at best, provide an estimate of the government total transfer, which in most situations would be a lower bound estimate of the economic cost of subsidies. A partial equilibrium model is not capable of explaining or predicting the effect of subsidies on trade patterns, prices, or resource allocation. General equilibrium models provide the theoretical foundations for this task.

Porter: Fisheries Subsidies as a Trade Issue

Porter claims that subsidies result in trade distortions and create a trade policy issue. He considers the urgency of fisheries subsidies derives primarily from the direct economic and environmental losses of over-fishing. Subsidies to over-capacity have two kinds of impacts on global trade: first, impacts on supply and price, and second, impacts on trade flows among countries. When fishing is subsidized, the level of production is higher because factors of production are not charged at full cost. In the short term, subsidies result in lower prices for that species but contribute to eventual depletion of fish stocks, reducing supply and driving up prices (see also Chichilnisky, 1996). The aggregate impact worldwide has been to increase seafood production well beyond the level that would have resulted without subsidies.

However, as Porter notes, the extent to which subsidies distort trade in fish and fish products has never been systematically analyzed. In part, this can be explained by a lack of data on factor costs, prices and subsidy regimes, but also because of the heterogeneous and perishable nature of fish products (McLeod, 1996).

Faehn and Grunfield: Impact of Free Trade on Norwegian Industry

Faehn and Grunfield (1999) use a computable general equilibrium (CGE) model to analyse the simultaneous industry and trade effects of all recently adopted trade agreements, including:

1. the WTO agreement;
2. the EFTA resolution on the removal of subsidies that distort international competition in the fishing industry was effected from 1994;
3. the OECD agreement (yet to be ratified) on removing state support to the ship building industry from 1996; and
4. the EEA fishing agreement implemented from January 1994.

The above reforms involve considerable changes in the Norwegian import regime; export conditions, government aid, and regulation and procurement conditions. The CGE model assumes constant returns to scale and perfect competition. The long-run solution that follows from the trade reforms is compared with the counterfactual policy scenario that assumes none of the above agreements are ratified. The robustness of the conclusions is tested by a 50 percent increase in all trade elasticities.

Exports of fish are set exogenously and imports are determined by equilibrium in the product markets. Policy measures enter the model in the following ways: *ad valorem* tariffs and tariff equivalents, and production subsidies. Production in the fishery sector is exogenously determined.

Table 3.1: Subsidies to production sectors in 1991

Sectors	Net subsidies (million ECU)	Net subsidy rate ^a
Agriculture	1473	42.8
Forestry	28	5.1
Fishery	159	11.0
Manufacturing product industry	121	1.4
Hardware and machinery industry	55	0.9
Building of ships and platforms	177	3.0
Construction	110	2.0
Finance and insurance	-291	-2.2

^a net subsidy expressed as percentage of gross production value in the sector.

Barriers on imports are quantified by the goods' *ad valorem* protection rate or equivalent tariff defined by the gap generated between the import price and the lowest possible import c.i.f. price. Table 3.1 shows the subsidies to production sectors in 1991. Net subsidy rates in 1991 were kept constant through the reference path. Removing the EFTA resolution on fisheries results in the subsidy rate falling by about 40 percent. It is

assumed that the OECD agreement on aid to shipbuilding will remove all direct subsidies to the ship building industry.

Approximately 80 percent of Norwegian exports are sold on EU markets. In 1991, EU tariffs on fish products ranged from 10 to 30 percent. The EU also retained an option to employ minimum prices and anti-dumping measures on Norwegian fish products. The calculated shifts in foreign demand for fish shows a positive increase in volume (above the reference path) of 3 percent; the export volume of ships falls by approximately 12 percent. Net exports of fish were found to fall marginally, due to enhanced domestic demand from the consumption goods industry.

The CGE analysis of the trade reform package shows significant changes in export demand and increased competition in domestic markets. Industries are shown to be affected quite differently by the direct effects of trade reforms and by the induced cost shifts due to resource constraints. The treaties tend to enhance growth in production of highly processed and differentiated goods and services, at the expense of less manufactured goods and more energy demanding goods. More liberal trading policies result in impulses that benefit highly processed tradables.

The OECD Study

The study was limited to government financial transfers and their effects on resource sustainability. Other effects were not explored in the study *viz.* the effect on trade flows, investment decisions, and the impact of subsidies on fishing capacity and activity on the high seas stocks and the stocks in other countries EEZs. Eight OECD member states - Australia, Canada, the European Community, Iceland, Japan, New Zealand, Norway and the United States - provided information. Government financial transfers were defined as the monetary value of interventions associated with fishery policies, whether they are from central, regional or local governments. Market price support was not covered. No attempt was made to examine the impact of government transfers on trade and trade patterns. Transfers were classified as:

- *Direct payments* from government budgets (i.e., financed by taxpayers) to fishers, including payments based on the level of catches, sales or on a per vessel basis; overall fishing income; fishers' historical interest.
- *Cost reducing transfers* such as those that reduce the costs of fixed capital and variable inputs.
- *General services* such as transfers paid from governments' budgets for fisheries management, enforcement and research costs, stock enhancement, and development of fishing ports, free berthing at ports.

Total government financial transfers in the OECD are estimated at US\$ 6.3 b. which is equivalent to 17 percent of the landed value of marine capture fishery products. The estimated total is probably too low as it does not include significant support items for some countries such as market price support, tax concessions, non-payment of fishing port berthing fees, support to builders of fishing vessels and regional and local government expenditures. At least US\$4.9 b (77 percent of all transfers) was spent on general services in 1997 - 13 percent of the value of the landings. Common examples of general services are expenditures on fisheries research, enforcement, management, enhancement and infrastructure. A further US\$1.4 b. was spent on support in the form of direct payments and cost reducing transfers to the sector in 1997 - 4 percent of the value of landings. Common examples include modernization grants, decommissioning payments, tax exemptions and income support. There is a wide range of transfers within the OECD group. The total value of transfers - expressed as a percentage of landings - ranges from 1 to 90 percent. Eight countries transfer funds valued in excess of 20 percent of the value of total landings. Four countries transfer less than 5 percent.

Estimates of Subsidies by Milazzo

The roots of Milazzo's (1998) study can be traced back to the earlier FAO (1992b) study which inferred that global fisheries were running at a deficit of US\$54 b. Milazzo poses the following question: "How do subsidies help to explain the increasingly obvious and injurious mismatch between effort/capacity and available resources? (p.2)" The study is confined to fisheries subsidies provided to the harvesting sector and not the entire fishing industry. Subsidies are calculated in terms of:

- Budgeted costs to the subsidizing government.
- Unbudgeted costs in the form of lending and tax preference afforded to the industry. The economic effect is measured as the difference between the price the receiver pays and the market price. Tax preferences are measured in terms of lost revenue.
- Access subsidy where government fails to adequately charge commercial users. Because market prices are generally not available, user fees were addressed inferentially.

Six economies are reviewed: Japan, the EU, Norway, the United States, Russia and China. The six economies account for nearly half of the world fisheries harvests.

Table 3.2: Estimates of Global Fisheries Subsidies

Estimates of Global Fisheries Subsidies (US \$ billions)		
Category	Low	High
Budgeted subsidies		
1. Domestic	3.0	3.5
2. Foreign access	0.5	1.0
Unbudgeted subsidies	6.0	7.0
Cross-sectoral subsidies	1.5	2.0
Resource rent subsidies	3.0	7.0
TOTAL	14.0	20.5

Milazzo acknowledges that the estimates summarized in Table 3.2 are rough and illustrative. Because the study did not reach below the national level, he suggests that the estimates are probably conservative. Thus, given global ex-vessel sales of around US\$80 b., the estimate of subsidies is about twenty to twenty-five percent of world revenues. In other words, effort and capacity-enhancing subsidies amount to about one-fifth to one-fourth of global revenues.

Trade distortions are not considered within this study.

Fisheries Access Agreements

The introduction of the EEZ led a number of leading fishing nations to negotiate access of their vessels to fishing grounds in other nations. In many instances the governments concerned have paid the cost of access by drawing on public funds. It seems that the trade distorting aspects of these agreements have not been reviewed, with the exception of the observations made by Porter in his 1997 study.

Porter (1997) reviews the EU's agreements with African countries. He concludes that the impact of Euro-African agreements on trade is two-fold. First, local fishers are competing with subsidized capital-intensive fishing vessels. Not only will their costs of production increase but the profit per unit of harvest will fall as stocks decrease. Theory would suggest that fish will become increasingly expensive to local consumers. With regard to consumers of fish caught by vessels under EU-African agreements, little can be said other than that the costs of production are relatively low and *ceteris paribus* the supply price of fish to their markets is lower relative to their real opportunity cost. One cannot say whether the suppliers enjoy the benefits and or the consumers – probably both.

4. CONCLUSIONS

Quantitative estimates of fisheries subsidies are of course necessary for a systematic study of the impact of subsidies on trade in fish and fish products. Collectively, the work of Milazzo (1998), the OECD (2000) and a limited number of case studies (e.g. Porter, 1997) show that it is possible to derive an estimate of the full range of government transfers. Milazzo (1998) provides an estimate that is about 20-25 percent of world revenues while the OECD (2000) study finds government financial transfers in the OECD at 17 percent of landed value. Both the Milazzo and OECD studies show that it is possible to estimate subsidies across countries. The range of subsidies, expressed as a percentage of revenue, is wide; in the OECD, estimates varied from 1 to 90 percent.

The review uncovered little systematic analysis on the effects of subsidies on trade in fish products. Dynamic models, as used by Arnason (1999) and Chichilniski (1996), could be extended to analyse subsidies, trade and governance. Although theoretical, these models can yield powerful insights.

Estimates of government transfer provide a partial equilibrium estimate of a portion of the total economic effect (unknown) of a subsidy (see Figure 2.2). Ideally the likely impact of subsidies on trade in fish and fish products should be based on relevant trade theory. Computable general equilibrium (CGE) simulations are particularly suitable for "big-picture" analysis of removing distortions in international trade. The models combine real-world data with a set of behavioral assumptions based on general equilibrium theory. Simulations – based around APEC initiatives – have been undertaken at the APEC Study Centre (University of Auckland) using the GTAP (Global Trade Analysis Project) data base (see for example, Scollay and Gilbert, 1998). The GTAP data base combines detailed bilateral trade, transport and protection data characterizing linkages between regions with individual economy input-output databases which describe intersectoral linkages within regions (Hertel, 1997).

The CGE model developed by Faehan and Grunfield (1999), shows how trade reform can result in significant changes in export demand and increased competition in domestic markets. The analysis also shows how reform can enhance growth in production of highly processed and differentiated goods and services. However, the trade reforms applied to the Norwegian case study are bundled up and it is not possible to identify the specific impact of fishing subsidy reforms.

The review did not uncover any published articles describing the results of econometric analysis of subsidies and trade fish and fish products. In summary, the extent to which subsidies distort trade in fish and fish products has not yet been systematically analyzed.

Appendix A: Fisheries and Trade

In 1996 total world fish production reached 121 million tonnes. Aquaculture output increased dramatically while capture fisheries production increased slightly (FAO, 1999). In 1996 aquaculture accounted for 20 percent of global fisheries production. China, Peru, Chile, Japan, the US, the Russian Federation and Indonesia accounted for more than half of the world's capture fisheries production in terms of tonnage. For the world as a whole, landings of marine fish are continuing to level off. Total marine catches of the main fishing areas in the Atlantic Ocean and some in the Pacific Ocean appear to have reached their maximum potential. Reviews of major fish stocks show 44 percent are fully exploited, 16 percent are over-fished, 6 percent appear to be depleted, and 3 percent are recovering slowly. The potential exists for an increased harvest in parts of the Pacific Ocean and Indian Ocean.

Aquaculture provided 20 percent of global fisheries production in 1996. China continues to be the largest producer accounting for more than 67 percent of the world output. Although Japan, Norway and the US are among the top ten producers, aquaculture production is predominantly carried out in low-income-food-deficit (LIFD) countries. The contribution of the LIFD countries to global production of aquaculture has increased sharply since 1990.

Capital-intensive vessels using advanced technologies account for three-quarters of the world's wild capture (WTO, 1997a). Approximately one-third of global fish production enters international trade and is concentrated primarily on high-value fish and fish products. Trade patterns for high value fish products are dominated by imports to developed countries, of which approximately a half originates in developing countries. An estimated 87 percent of industrialized countries' exports of fish and fish products, measured in terms of market value, were destined for other developed countries. The total value of exports from developing nations increased from US\$5.1 b. in 1985 to US\$20 b. in 1995.

Fish, shellfish, and fishery products are widely traded. In 1996 export volumes reached more than 22 m tonnes, or roughly 40 percent of global fisheries production (FAO, 1999). The export sector earned US\$52.5 b. in 1996 – representing about 11 percent of total agricultural exports and 1 percent of total merchandise trade. No less than 195 countries export part of their production and some 180 countries import fishery products. The volume of trade (measured in tonnes) has trebled since 1976, reflecting increased production, particularly aquaculture, and increased demand.

Fishery exports by value are almost entirely (95 percent) composed of food products, although in terms of volume, fishmeal and oil account for a much greater share. In value terms, more than half of global export trade originates in developing countries and consists largely of imports into developed countries. Thailand was the leading exporter between 1993 and 1996, with exports reaching US\$3.2 b. in 1996 (around 6 percent of total exports). In 1997 Norway's exports were the highest at US\$3.4 b. overall, developing countries account for approximately half the value of total exports. For some economies, the export of fish products is particularly vital to the national economy. In particular, for Iceland, the Faeroe Islands, Greenland, Maldives and Seychelles, fish products represent more than 75 percent of total merchandise exports. In a further 20 countries, including Chile, Ecuador, Kiribati, Madagascar, Mauritania, Morocco, Mozambique, Namibia, Peru and Senegal, fisheries exports account for between 10 percent and 75 percent of total merchandise exports. Despite the importance of fisheries to their individual economies, none of the above countries account for a significant share of the world market and taken together, their exports account for only 15 percent of the total.

Japan is the leading importer of seafood products with US\$15.5 b. worth of imports in 1997 (or 30 percent of total imports). The US accounts for 10 percent of world fish imports. Imports by Japan, the US and the European Community account for 75 percent (in value terms) of internationally traded fish products.

The value of world exports increased at a slower pace during the 1996-97 period reaching US\$52.5 b. (FAO, 1999). The economic importance of fisheries is underscored by the number of economies that derive a significant share of their export earnings from trade in seafood products, especially the economies of developing countries. In 1996 developing economies achieved a net trade surplus of US\$16.6 b. International trade in fishery products is also of importance to developed economies, including the EU, who import about

75 percent of internationally traded fish products. The relative efficiency of the mechanisms underpinning the production, processing and trade in fish and fish products is therefore of great economic interest.

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REVIEW OF METHODOLOGIES USED TO ASSESS TRADE - DISTORTING IMPACT OF SUBSIDIES TO THE FISHERY SECTOR

by

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1. Background

Before addressing early attempts to measure the trade-distorting impact of subsidies in the fisheries sector it is instructive to briefly discuss OECD attempts to measure distortions associated with agricultural policy.

There were three limbs to the OECD's examination of the effects of agricultural policies in the 1980s (OECD, 1990). First, the policies were documented and quantitative measures of producer subsidy equivalent (PSE) and consumer subsidy equivalent (CSE) estimated.¹ The PSE/CSEs provided measures of the degree of intervention. The work centred on detailed country studies analysing the whole set of agricultural policies and other policies affecting agriculture. PSE/CSEs became the leading indicators of assistance to agriculture in OECD countries.

Second, the OECD developed a Ministerial Trade Mandate (MTM) model that showed the effects of agricultural subsidies on patterns of production, consumption, international trade and world prices for the main agricultural commodities. MTM simulations provided indications of the economic effects of changes in farm support policies. Trade and intersectoral linkages were treated in considerable detail. The results of MTM analysis coupled with PSE/CSE estimates called attention to the cost of current policies and the extent to which supports were depressing world agricultural prices. This led to a concerted effort to reform agricultural policies and allow the market to work.

Third, the interest of governments in examining the economy-wide effects of agricultural policies and in quantifying their effects on economic efficiency and welfare motivated the development of a computable general equilibrium (CGE) model. Specific policy instruments (e.g. input subsidies) were modelled using the CGE model. One of the most politically relevant questions in trade liberalisation is its transitional adjustment costs.

Steenblik and Munro (1998) report that the OECD has been working on fisheries subsidies since 1965. Three surveys of financial support to fishing industry were completed, the last appearing in 1980. The latest OECD assessment was published in 2000.

The OECD Fisheries Committee tried to apply exactly the same methodology as had been used for agriculture. According to McLeod (1996) the Fisheries Committee came up against two basic difficulties:

- There was a problem of establishing an external reference price for main fish species because fish products were heterogeneous and perishable and, in many instances, trade was limited. Vertical integration in the industry introduced additional problems.
- Most agricultural subsidies took the form of price support and were highly measurable. In contrast, assistance to the fishing industry was delivered largely in the form of subsidies on inputs.

¹ Mathematical definitions of PSE/CSE are found in OECD (1990). According to Schwartz and Parker (1988) PSE focuses on income transfers to producers. Effective rate of protection (ERP) is considered the best analytical measure of trade distortions for production.

Apparently the OECD project got bogged down with some member countries refusing to continue. Eventually the project was abandoned. An attempt by Bogle and Gates (reported in McLeod 1996) to establish PSEs on a commodity-by-commodity basis failed. Instead they calculated PSEs in the form of assistance to the fishing industry as a whole. Bogle and Gates experienced great difficulties in defining and measuring forms of assistance. At the time, McLeod (1996) notes that there was a need to develop a methodology appropriate for measuring assistance to fishing industries and its effects on trade.

Methodological Issues

The OECD research program on the effects of agricultural policies clearly demonstrates the benefits of a coherent program. The "problem" was broken down into manageable parts that could be intensively studied and then integrated back into a whole. It would appear that researchers worked "closely" with their government counterparts and the policy dimension was at the forefront of their modelling efforts.

From the very limited review of OECD work the attempt at applying the methodologies developed for agriculture to fisheries failed. While the reasons advanced for this failure appear valid, there appears to be no convincing reason why the difficulties could not be solved. The fact that fish products are heterogeneous and perishable calls for a different, possibly more aggregated, approach. Similarly, if vertical integration is a problem then the economic modelling work should turn its attention to examining trade liberalisation within the context of imperfect competition. In other words, these difficulties are not sufficient to prevent assessments of trade-distorting subsidies.

Similarly, the fact that assistance to the fishing sector comes largely in the form of input subsidies should not hamper assessment. Studies completed by Milazzo (1998) and more recently OECD (2000) clearly shows that it is feasible to get reasonably robust estimates of direct government transfers to the fishing sector.

With this background in mind, the following conclusions are drawn after a review of the methods used in disputes concerning the subsidized production and export of Atlantic salmon from Chile and Norway.

- *Product definition:* Fresh and chilled Atlantic salmon is eminently suited to precise definition. Substitutes were easily identified.
- *Data:* The cases reviewed relied on official government statistics coupled with primary data gathered using questionnaires. Questionnaire respondents spanned stakeholders – government, consumers, producers and exporters in both countries. Employment, investment and information on interest rates were obtained. Data were transparent, contestable and public, except for commercially sensitive data.
- *Industry structure:* Industry structure – at the production, distribution and retail level – was described.
- *Government policy:* Program details were provided by government, and the specifics of each program (e.g. interest rates) could be easily compared against commercial alternatives.
- *Market:* The competitiveness, or otherwise, of markets (domestic, global) was established.
- *Economic modeling:* Conceptual models played a useful role in assisting commissioners organise factual material, establish linkages between economic variables and arrive at conclusions.
 - There did not appear to be any reliance placed on econometric modeling developed especially for the hearings. Statistical analysis was applied to quantity and price trends. Refereed journal articles were used to establish bounds on important parameters – for example, elasticity of demand and elasticity of supply.
 - General equilibrium issues were canvassed in a qualitative way.
- *Causation:* Establishing a plausible and defensible relationship between subsidies and material injury was possibly the greatest challenge facing commissioners. The arguments canvassed used economic data but did not rely on econometric modeling. The idiosyncratic nature of the cases is probably one reason for this, the other being that the period of investigation was typically one year. Time series analysis may have been able to shed further light on the dynamics of market adjustment.
- *Broader institutional context:* Establishing an institutional context that is relevant to the situation is necessary. In the case of farmed Atlantic salmon this may be straightforward. However, when it comes to wild capture fisheries the impact of alternative governance arrangements would have to be controlled.

- *Estimating subsidy*: The methodologies used to quantify recurring subsidies is transparent and accords with economic principles. *Ad hoc* annualised allocations were made lump sum subsidies for capital equipment.

2. Case Studies

2.1 Fresh Atlantic Salmon From Chile

The petition was filed by the Coalition for Fair Atlantic Salmon Trade (US Department of Commerce, 1997). Subsidies were measured over one calendar year 1996.

Scope

The scope of the investigation was broad and covered fresh, farmed Atlantic salmon, whether imported dressed or cut. Excluded from the scope were:

- fresh Atlantic salmon that is not farmed;
- live Atlantic salmon; and
- Atlantic salmon that has been subject to further processing.

Method

Factual information was obtained by a series of questionnaires:

- Additional stakeholder input: the DOC invited comments on the scope of the proceedings.
- Questionnaires: due to the large number of producers and exporters, the DOC issued a countervailing duty questionnaire to the Government of Chile (GOC). The aim was to gather industry level data rather than collect data from numerous producers and exporters. As it turned out the GOC lacked information on a number of specific programs and the DOC issued an additional questionnaire to four producers/exporters.
- Follow-up questionnaire: the petitioners were successful in arguing for the inclusion of an additional program. The DOC requested additional information on the program from the GOC.
- The DOC sent out two follow-up supplemental questionnaires.

To calculate countervailable benefit from loans and nonrecurring grants, the DOC used average rates for the US dollar lending in Chile. US dollar interest rates were used because the loans were denominated in US dollars. The analysis used nine years as the weighted-average useful life of productive assets for the Chilean salmon industry.

Programs Preliminarily Determined to be Countervailable

- *Export Promotion Assistance*: aimed at promoting and diversifying exports by providing grants to private companies or industries. Projects typically include advertising and assistance with promotional activities. The DOC considered the activities related to promotion of a specific product or provided assistance to a firm. In other words the projects were not general export promotional activities. The promotion grants were determined to provide countervailable subsidies. Steps taken to calculate countervailable subsidy:
 - Allocate grants where the benefits exceeded 0.5 percent of the value of the appropriate exports in the year of receipt.
 - Divide the benefit by the value of appropriate exports.
 - Finding: countervailable subsidy rate for the program to be 0.05 percent *ad valorem*.
- *Export Credit Insurance Premium Assistance*: This assistance was provided for small and medium-sized companies – companies with annual sales of no more than US \$ 10 m. A grant of up to 50 percent of the value of the export credit insurance premium, subject to a cap of one percent of the particular export invoice. Payments are made directly to insurance companies. Payments of

insurance premiums are specific and were determined to constitute countervailable grants. As a direct transfer of funds, the benefit conferred is the amount of the grant. Steps taken to calculate the countervailable subsidy:

- o The benefits were treated as recurring.
 - o Divide the benefit by the value of all exports of fresh Atlantic salmon by producers and exporters for the year.
 - o Finding: countervailable subsidy for this program to be 0.01 percent *ad valorem*.
- *Deferred and Waived Import Duties on Capital Goods*: Customs duties may be deferred and subsequently waived on imported capital goods used in the production of exports. During the deferral period the amount of duties owed is treated as a loan and the exporter pays interest. If the capital goods are used for the production of exported goods the outstanding balance and interest on the loan are waived. Usage data provided by the GOC indicated that the fishing and aquaculture sector was neither a predominant nor disproportionate user of the program. Some non-exporting sectors – e.g. gas and water – used the program. The waiver of import duties represents foregone revenue by the GOC proved a benefit in the amount of the waiver. Because the benefit is contingent on export performance, The DOC determined it to be countervailable. Steps taken to calculate the countervailable subsidy:
 - o GOC provided amounts of custom duties waived for relevant exporters of Atlantic salmon.
 - o Benefits were considered recurring.
 - o Divide the total amount of waivers granted by the value of exports of producers and exporters of salmon for the year.
 - o Finding: countervailable subsidy for this program to be 0.23 percent *ad valorem*.
- *Import Substitution of Capital Goods*: The program seeks to encourage capital investment and to avoid a preference for imported capital goods. Companies buying domestic capital goods can borrow up to 73 percent of the amount of custom duties that would have been paid on capital goods if they had been imported. If the capital is ultimately used to produce exports then the loan balances and any unpaid interest are waived and the producer is not required to repay the loan. The loans were determined to be specific because they are contingent upon the purchase of domestic capital equipment. For the interest subsidy, steps taken to calculate the countervailable subsidy:
 - o Subtract the interest charged during 1996 under the program from interest under the benchmark rate.
 - o Divide the difference by all sales of producers and exporters of salmon.
 - o Finding: countervailable subsidy for this program to be 0.02 percent *ad valorem*.
 - o For the waivers provided, steps taken to calculate the countervailable subsidy:
 - Divide the total amount of the waivers granted during 1996 by value of all exports of producers and exporters salmon.
 - Finding: countervailable subsidy for this program to be 0.25 percent *ad valorem*.
- *Promotion and Development Fund*: Fund to aid in the development of remote areas of Chile. The program provides grants (15 percent of the cost incurred in 1981 and 20 percent of the cost for years 1982-99) for new or reinvestments. The grants are a direct transfer of funds from the GOC providing a benefit in the amount of the grant. Steps taken to calculate the countervailable subsidy:
 - o Grants are non-recurring.
 - o Allocated over time, the grants from those years in which the benefits from the program exceeded 0.5 percent of the value of sales of producers of salmon in the year of receipt.
 - o Divide the benefit attributable to the year 1996 by the value of all sales of producers and exporters of salmon.
 - o Finding: countervailable subsidy for this program to be 0.01 percent *ad valorem*.
- *Duty Drawback System – Small Volume Exports*: The program was the subject of additional arguments for inclusion by the petitioners. Exporters using domestically produced inputs in their export operations are entitled to the amount of duty drawback that the exporter would have otherwise paid if they had imported the inputs. Maximum export values are applicable and the list of eligible inputs is updated each year. The transfer is specific because it is contingent upon export performance. Steps taken to calculate the countervailable subsidy:

- Treat the grants as recurring.
- Divide the total amount of grants received during 1996 by the value of all exports of producers and exporters of salmon.
- Finding: countervailable subsidy for this program to be 0.05 percent *ad valorem*.
-

Programs Preliminarily Determined Not to be Countervailable

- *Fundacion Chile Asistencia*: This is a private non-profit organization established using an endowment that had its origins in earlier times. The organization's mission is to carry out scientific and technological research and apply the research to industrial production and service areas of Chile. The company co-invested in salmon related ventures. The DOC determined that the decision to invest was consistent with the normal investment practice of private investors in Chile. The company also provides, and charges a fee for, technical assistance. The fees charged were found to be in line with other service providers.
- *Fund for Technological and Productive Development*: This program provides grants for research and development projects. The DOC preliminarily determined that the program was not specific because the benefits are not contingent on export performance. Furthermore the grants were considered not to be *de facto* specific because a large number and wide variety of users were involved. The salmon industry was not a predominant or disproportionate user.
- *Central Bank*: Petitioners alleged that the Bank used its authority in approving debt swaps to promote export-oriented industries and import substitution. Based on the evidence provided by the GOC the DOC determined that the benefit, if any, is not specific.
- *Export Credit Limits*: The program allows a Chilean Bank to lend a greater percentage of its paid-in capital to export customers. Because access to credit does not appear to be a constraint, the DOC preliminarily determined that the credit limits do not constitute a countervailable subsidy.
- *Stamp Tax Exemption*: No benefit was determined because the amount of the exemption is not greater than the tax due.

Summary

The total estimated preliminary net countervailable subsidy rate for all producers or exporters of fresh Atlantic salmon in Chile of 0.62 percent *ad valorem de minimis*. Therefore the preliminary determination was that countervailable subsidies are not being provided to producers or exporters of fresh Atlantic salmon in Chile.

2.2 Salmon From Norway

The proceeding was initiated as a result of a complaint jointly lodged by the Scottish Salmon Growers' Association and the Shetland Salmon Farmers' Association. The complaint contained sufficient evidence of subsidization of the imports and of material injury to justify the initiation of an anti-subsidy proceeding. A parallel anti-dumping proceeding was also initiated.

The period used for the investigation was 1 January 1995 to 31 July 1996. For certain injury indicators – e.g. price undercutting; a 12-month period August 1995 to July 1996 was used.

The proceeding treated farmed Atlantic salmon, whether or not fillet, fresh, chilled or frozen, as a single product. The definition excludes other similar farmed large trout, other salmon species and processed salmon. Farmed Atlantic salmon produced by the Community was considered like product.

Subsidies are considered countervailable unless they are non-specific or fall into one of the "green light" categories (R&D, Regional or environmental aid). The amount of subsidy is calculated on the basis of "benefit to the recipient". Since none of the subsidies in question are granted with reference to quantities manufactured or sold, and there are no export subsidies involved, the amount of each subsidy is allocated over total sales (either of the cooperating company or over the entire industry) and expressed *ad valorem*.

Council acknowledges that the subsidy may confer different benefits within the industry. A single rate of subsidy is calculated because the only instrument available is a countrywide duty. If importers consider that

they have obtained salmon from less or non-subsidized growers/exporters then they can request refunds of the countervailing duty.

Method

The European Commission notified known associations representing salmon producers and exporters in Norway. Producers and exporters were asked to contact the Commission. In Norway there are around 650 salmon farmers and 200 to 300 exporters. Given the large number of operators, it was agreed at an early meeting of interested parties that a selected number of farmers and exporters should initially provide a response.

Approximately 100 companies made themselves known to the Commission. The Norwegian industry alleged that they accounted for about 25 percent of Norwegian production and 60 percent of exports.

Thirty-two producers/exporters replied to the questionnaire. The questionnaire provided sufficient and adequate information to be representative of Norwegian salmon production for certain parts of the investigation. Coverage was not adequate for other parts. The Commission investigated injury on the basis of a representative sample of Community producers.

Community (of 15) consumption of farmed Atlantic salmon was calculated. Imports into the Community were established. Volume and market share of the subsidized imports was established. It was determined that Norwegian imports had been able to maintain their very high market share (around 60 percent) in a fast-growing market.

Statistical data were used to show that the cif import price of salmon originating in Norway fell continuously and overall by 27 percent, between 1992 and the last 12-month period under investigation. Prices of sampled Community producers were compared to the prices of Norwegian exports. The results showed the existence of monthly undercutting margins of up to 12 percent. Undercutting was found to peak at the period preceding Christmas. Salmon is traded as a commodity in a transparent and competitive market. Thus the undercutting margins should be seen in the context of continuous pressure exerted by the Norwegian imports on market prices.

The situation of the Community industry was characterized. Total production, volume of sales and market shares established. Capacity and utilization rates (found to be around 59 percent) were established for the 12-month period.

Price evolution was tracked. Prices in the sampled set of Community companies decreased by 24 percent over the 12-month period. The reduction was very close to the reduction in prices of imports from Norway. Thus, it was established that the Community industry was unable to resist pressure from Norwegian prices. The majority of Community producers were not profitable during the 12-month period.

Employment and investment was quantified.

In concluding that the Community industry had suffered material injury during the period examined, account was taken of the price pressure faced by Community producers; declining profitability and closure of a number of plants; and, declining Community market share.

Causation

For the purpose of deciding whether the injury suffered by the Community industry was caused by the subsidized Norwegian imports, the following elements were considered:

- o Causal link between imports and injury: the continuous price pressure and reduced profitability for the Community producers coincided with a significant increase in the volume of dumped and subsidized Norwegian imports of salmon. Consequently, Norway could maintain its high market share.
- o Prices of these imports fell significantly and undercutting of up to 12 percent was found. It was concluded any downward pressure on prices was most likely due to the main supplier, Norway.

- It was concluded that the combined effects of dumping and subsidized of Norwegian imports have caused material injury to the Community industry.

Interests of Consumers

Consumer representatives argued that protection would not be in the interest of consumers in the Community. The Commission argued that the availability of substitute products suggested that the impact on the final consumer would be minimal. No data were presented. Further, because any duty would be levied on cif price the impact on retail prices would be lessened. The average consumption of salmon in the Community was estimated at 0.8 kgs *per capita* and suggests that the overall impact would be small.

Programs Found to be Countervailable

- *Differentiated social security contributions*: Norway applies a differentiated employers' social security scheme. Contributions vary across the country, favouring the more remote regions. Analysis of the questionnaire revealed that the differentiated employers' contribution to social security constitutes a financial contribution by government. The scheme was seen to be equivalent to a system of reductions and exemptions from the basic rate and confers a benefit to those enterprises that qualify. The subsidy was considered to be specific because zones were used to base contribution rates. Steps taken to calculate the benefit:
 - Social security contributions of cooperating and verified producers in zones paying less than the basic rate in the reference zone.
 - Subtract the actual payment of social security from the basic rate in the reference zone.
 - The difference was expressed as a percentage of the turnover of the cooperating and verified producers (including those in the reference zone).
 - Finding: benefit of this program was found to be 0.93 percent *ad valorem*.
- *Norwegian Industrial and Regional Development Fund*: The fund is operated by government and aims to promote the commercial and socio-economic development of Norwegian industry. Support is targeted at small and medium-sized enterprises and regions, which are economically underdeveloped. If financial aid is granted and a percentage of the total cost is covered by a grant, another percentage is usually covered by a loan. The scheme also guarantees loans and provides equity. The scheme is a subsidy and confers a benefit on salmon producers. The grants are specific and benefits have been disproportionately granted to fish farming. The Norwegian government claimed "green-light" treatment of the grants because they are approved within a general framework of regional aid. After considering details of the scheme, the Commission concluded that aid within regions was specific and none qualified for "green-light" treatment. The green-light claim was rejected. Steps taken to calculate the benefit:
 - In general grants were used for acquiring fixed assets, which according to Norwegian accounting conventions are depreciated at an annual rate of 15 percent (7 year period). The total amount of the grants to salmon growers during 1989-1996 was allocated on a straight-line basis over 7 years. The benefit was increased by taking into account the commercial interest rate that would have applied.
 - Total sales (domestic and export) of Norwegian salmon producers over the period were estimated.
 - Finding: the benefit of the grant programme was 0.48 percent *ad valorem*.
 - The loan program conferred benefits by offering interest-free periods, relatively lower interest rates, and loan write-offs. The annual benefit of the loan was based on the difference between the financial parameters of the scheme and the private sector. Finding: expressed as a percentage of annual turnover, the subsidy amounted to 0.19 percent *ad valorem*.
 - Losses incurred by non-repayment of loans were characterized as a *de facto* non-recurring grant and allocated over a 7-year period. The benefit of the loan programme was 0.74 percent *ad valorem*.
 - The loan guarantee scheme was also considered a subsidy because it provided loan guarantees that were not financed according to commercial criteria. The method used to calculate benefit associated with losses was used. Expressed as a percentage of total sales during the period, the subsidy is 0.74 percent *ad valorem*.

- *Transport Subsidies:* Norway operates a transport subsidy scheme that provides aid to compensate for the long distances to markets. There is a maximum ceiling of 30-45 percent of total transport costs. It was established that the program is specific and confers benefits. Steps taken to calculate the benefit:
 - Total grants to companies transporting salmon was calculated for the period 1995 and 1996.
 - Expressed the grant as a percentage of total sales value of salmon to arrive at a subsidy of 0.01 percent *ad valorem*.
- *Regional Commission:* The Commission's task is to elaborate policy and promotion of regional development. One grant was made to three companies and constitutes a subsidy. The amount of benefit was too small to be taken into account.
- *FOS/Fodfisk:* The Norwegian Fish Farmer's Sales Organization (FOS) was the sole exporter of salmon in Norway. In 1989 FOS intervened in the market to withhold supply in order to improve prices. A loan was used to finance the intervention. FOS got into financial difficulties and the banks and Norwegian government got together to find a solution. The banks and the government established Rodfisk. Rodfisk started repaying the farmers and also offered low interest loans to farmers. The benefit conferred was considered specific. Benefit was twofold: first, partial repayment of farmers claim to FOS and second, low interest rate loans. Steps taken to calculate the benefit:
 - Financial contributions were treated as a non-recurring grant and allocated over a 7-year period.
 - The margin between preferential and market loans was estimated.
 - The total subsidy was expressed as a percentage of total value of sales of the Norwegian salmon growers.
 - Finding: the subsidy is 0.94 percent *ad valorem*.

Programs Found not to be Countervailable

- The following programs were found to be non-actionable either because the contributions were below the limits or the schemes were priced at close to market prices.
 - *Research Council of Norway*
 - *Seafood Export Council North Norwegian Growth*
 - *Sties*
 - *State-owned banks*
 - *Other organizations such as Norwegian Salmon Breeding, State veterinary laboratories.*

Conclusion on subsidies

It was concluded that it is in the Community interest to impose countervailing measures on imports of farmed Atlantic salmon originating in Norway. The rate of duty applicable was determined at 3.8 percent.

2.3 Fresh and Chilled Atlantic Salmon From Norway

The US International Trade Commission initiated the investigation in June 1990. The Commission instituted an antidumping investigation in October 1990 following a preliminary determination by the DOC that fresh and chilled salmon were being sold at less than fair value. The period of investigation was 1987 – 1989.

The product was defined as: "Fresh and chilled Atlantic salmon refers to fresh or nearly whole Atlantic salmon, typically, (but not necessarily) marketed gutted, bled, and cleaned, with head on, and packed in fresh-water ice (chilled). Atlantic salmon smolts were included. Excluded are: fresh Atlantic salmon that has been cut into fillets, steaks, and other cuts; Atlantic salmon that is frozen, canned, smoked, or otherwise processed; and other species of fish, including other species of salmon.

When determining "like product" the Commission concluded:

- Physical characteristics: Atlantic and Pacific salmon belong to different species and genera;

- production: Atlantic and Pacific salmon production technology differs;
- channels of distribution: pass through different channels of distribution;
- interchangeability: pass through separate channels of distribution;
- prices: differ appreciably.

The Commission rejected the Norwegian respondents' argument to include Pacific salmon and steelhead trout as part of the "like product".

Method

Data were obtained from a questionnaire sent to producers. Twenty-two producers responded. Coverage of the industry is estimated at 95 percent. Secondary data from official statistics were also used to build up the database.

- *Sales at LTFV*: US prices were purchase prices paid by unrelated US purchasers. Foreign market value was based on data provided by a sample of Norwegian fish farmers and exporters.
- *Substitute products*: information was collected from distributors and retailers. Published articles were a further source of information. Standards for substitutability were found to vary across the market segments. At the high-end "white-table-cloth" trade, Atlantic salmon from various suppliers were generally considered to be substitutes. Supermarket and grocery chains were more willing to accept substitutes for Atlantic salmon, particularly fresh Pacific species.
- *World production*: historical record of farmed Atlantic salmon was quantified using data from the National Marine Fisheries Service and other international sources.
- *US market*: profiled according to *per capita* consumption, quantified from questionnaire responses of US producers and official import statistics.
- *US producers*: the number, size, structure (e.g. vertically integrated firms) and location of firms was described. Production, capacity, capacity utilisation, and employment was measured for the period.
- *US importers and channels of distribution*: numbers of firms and network described.
- *Financial experience of US producers*: eleven producers supplied income and loss data. These data are commercially sensitive and actual numbers are not reported. It appears that one large producer (Ocean Products) was studied in greater detail.
- *Norwegian Industry*: Information on the industry (e.g. capacity, production, exports, markets) was drawn from a report prepared by the National Marine Fisheries Service and a fact sheet prepared by FOS.

State of the industry

The Commission found the US Atlantic salmon industry to be "established", young and emerging. Other distinctive features included: a three-year production cycle which makes current supply of adult salmon a function of production decisions (*viz.* juvenile Atlantic salmon) made in earlier years.

US market for fresh and chilled Atlantic salmon grew strongly over the period. Annual consumption nearly doubled to exceed 40 m pounds. The increase in value terms was around 50 percent, exceeding US\$160 m in 1989.

From 1987 to 1989 US firms' capacity to produce juveniles increased substantially and production of adult salmon increased by over 200 percent from 1987-88 to 1988-89. In terms of value, annual smolt shipments followed the same trends in production. In terms of gutted Atlantic salmon shipments, the value of US shipments increased from US\$5.65m in 1987-8 to US\$10.8 m in 1989-90

The number of production and related workers increased from 117 in 1987 to 265 in 1989.

Performance of industry

The domestic industry recorded an overall operating profit in 1988. However from 1988 to 1989 net sales fell, costs increased and large operating losses followed. The largest US producer ceased operations and was sold. At the time, the US industry was not on the road to further expansion to achieve the economies of scale in production which might enable it to lower unit costs and re-establish profits. In summary, the Commission found that the US Atlantic salmon industry was experiencing material injury.

Causation

The Commission had to decide whether the material injury arises from the Norwegian imports. US import data were used to quantify (by volume and value) imports from Norway and other countries during the period of investigation. Published results of econometric analysis were used when examining demand and issues such as substitutability and price elasticity. The Commission collected price data from published sources for Atlantic salmon, and requested additional data from US producers and importers where necessary. The official record removes commercially sensitive information provided from industry.

Statute directs the Commission to consider, but not to weigh, the following.

- *Volume of imports:* the quantity and value of imports from Norway increased from 1987 to 1989. Despite increases in absolute terms, market penetration of Norwegian imports fell over the period. In 1990 subject imports by volume and value accounted for 37.7 and 40.8 percent respectively. Earlier proceedings played a role in the precipitous drop in imports toward the end of 1990, as did the appreciation of the Norwegian kroner. The Commission found the volumes of imports from Norway to be significant, particularly when set alongside the state of the US industry.
- *Effect on prices:* prices for US Atlantic salmon fell up to one-third by the end of 1989. Prices for the "like" product closely tracked prices for Norwegian Atlantic salmon. Decline in US prices was due in large part to oversupply in the US market. Imports from Norway accounted for a large portion of the increased imports in 1989. There is a high degree of substitutability between US and Norwegian Atlantic salmon. Given the volume of increase in Norwegian imports in 1989, falling prices, close tracking of US and Norwegian price trends, and close substitutability, the Commission concluded the imports significantly depressed prices for the like product.
- *Impact of domestic producers:* The lagged nature of the production function means that on-going production costs must be absorbed while the product comes on stream. Lower prices in 1989 adversely affected US producers. This, in turn, resulted in a levelling off of production of juvenile salmon. Banks became increasingly reluctant to supply finance.

Economic Models Applied

Three economic models were used to provide a dynamic link between prices and quantities. These models were used to help form a background by which to understand the nature of decisions facing US producers in 1989. All three models link price and production decisions under different behavioral assumptions.

- *Cobweb model:* states that quantity supplied this period is a function of last period's price, price this period is a function of quantity demanded this period, that quantity supplied this period equals this period's demand and quantity supplied next period is a function of this period's price. Applied to this case, this suggests that salmon producers in 1989 would cut back on planned replacement stocks if prices in 1989 were seen to be too low to justify continuing production at current levels.
- *Adaptive expectations:* this model postulates that changes in production are related to changes in expected prices. In other words, producers would adjust their production levels according to an expected price level, which is a function of the difference between current and past prices. Evidence showed US producers using a variation of this model when forming price projections.
- *Rational expectations:* assumes that producers would use a variety of information in determining their production levels. A list of possible explanatory variables might include historical prices, health, seasonal variability, regulatory regime problems, consumer incomes, and so on.

In the opinion of one Commissioner, all three models could have led a US salmon producer in 1989 to continue to expect low prices beyond 1989 and/or to decide that production cutbacks (or limiting expansion) would be the best course of action.

Dissenting view

The dissenting view concluded that the downward pressure on price was a global phenomenon and so the Norwegian producers were hurt as well. The dissenting Commissioner argued that the effect of import sales could only be established by looking at both demand and supply.

- *Demand:* consumers regard Atlantic salmon as a premium product. Estimates of price elasticity (that fall within the range of -1.0 and -2.5) were provided. Given elasticities in this range, the volume of salmon sold in the American market will vary greatly with price.
- *Supply:* the domestic elasticity of supply is very low (less than 0.5). Other things being equal, the principal effect of dumped and subsidized imports will be to depress prices for domestic "like" product, rather than decrease sales.
- *Supply from other Nations:* The elasticity of import supply is very high. By the end of 1990 both Chile and Canada were exporting more Atlantic salmon to the US than Norway. Moreover the elasticity of substitution between Norwegian and domestic salmon is high (between 3 and 6), even higher between domestic salmon and other foreign nations (6 to 10). These estimates corresponded to the observed fact that as the price of Norwegian Atlantic salmon increased, its market share fell.
- *Lingering effects:* Statute requires the Commission to decide whether a domestic industry is being materially injured. In other words, subsidized imports are causing injury and not a source of injury in the past.
- *Reason for decline of imports from Norway:* the explanation offered for the shift in exports of Norwegian Atlantic salmon from the US to Europe is the appreciation of the kroner against the US dollar.

Final Countervailing Duty Determination

In its 1991 final countervailing determination the International Trade Administration found the following programs to confer subsidies. Because of the large number of producers and exporters, information was solicited from government. The estimate of subsidy is based on benefits provided to the salmon industry and the total volume of sales as reported by the government of Norway.

- *Regional Development Fund (RDF) Loans and Grants:* The RDF provides loan guarantees, long-term loans and grants. The interest rate paid on RDF loans was subtracted from the commercial benchmark and the interest payment differential was divided by the total volume of fresh and chilled salmon sold during the review period. With respect to grants, recurring benefits were allocated in the year of receipt; non-recurring benefits were allocated over the useful life of assets in the industry. For salmon, useful life is ten years. Investment grants received by the salmon industry for each year over the previous ten years were aggregated. The grants received in each of the years were divided by the total value of salmon sales in that year. The net subsidy for RDF loans and grants was estimated at 0.25 *ad valorem*.
- *National Fishery Bank (NFB) of Norway loans:* The NFB provides long-term loans for investment in production equipment and buildings. Loans to salmon producers were written off during the period. Because NFB lending was limited to the fishing industry on terms inconsistent with commercial considerations, the program was considered countervailable. The interest payment differential on outstanding loans was divided by the total volume of salmon sold to arrive at a net subsidy rate of 0.03 percent *ad valorem*.
- *Regional Capital Tax Incentives:* The program aims to encourage investment in regions with a weak industrial base and considerable unemployment. Funds set aside by the taxpayer are deducted from taxable income. The set-aside funds must be fully invested within five years. The total amount of funds set aside by salmon producers and exporters was multiplied by 0.58 percent to determine the

amount of tax saving. The amount of tax saving was divided by the total volume of salmon sold during the review to arrive at a net subsidy rate of 0.06 percent *ad valorem*.

- *Reduced Payroll Taxes:* The program provides benefits to specific regions in Norway. The benefit was assessed by taking the difference between payroll taxes paid in the target regions and a weighted-average rate. The net subsidy was estimated at 0.42 per cent *ad valorem*.
- *Advanced Depreciation of Business Assets:* The program provides companies in selected districts an opportunity to claim a higher rate of depreciation in the year in which capital assets are acquired. Depending on location, companies can take a first-year deduction of either 25 or 40 percent. The program was considered countervailable because of its regional specificity. The net subsidy was calculated by dividing the tax savings to salmon producers by the total volume of fresh and chilled salmon sold during the period. The net subsidy was estimated at 0.01 percent *ad valorem*.
- *Government Bank of Agriculture grant:* The Bank administers a program that is designed to create supplemental income and employment for farmers. This program was determined potentially countervailable because salmon producers in northern Norway could receive a greater proportion of benefits relative to farmers located in southern Norway. However, it was found that none of the loans provided to northern farmers were above the maximum set for southern farmers. With respect to grants, because the difference between the amount received and the maximum amount permitted in southern Norway was less than 0.5 percent of total sales, the grant was allocated in the year of receipt. The regional difference was divided by the total volume of fresh and chilled salmon sold during the review period to obtain a net subsidy of less than 0.01 percent *ad valorem*.

Programs determined not to be countervailable were assessed using the above methodology. In each case, the existence of benefit was established by comparing the program's parameters (e.g. interest rate, treatment of delinquent mortgagors, etc) against the commercial counterpart.

Summary

The Commission determined the net subsidy to be 2.27 percent *ad valorem* for all producers or exporters in Norway of fresh and chilled Atlantic salmon.

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This document contains the papers submitted by the FAO Secretariat and resource persons to the Expert Consultation on Economic Incentives and Responsible Fisheries, held in Rome from 28 November to 1 December 2000. The papers comprise background information and discussion guidelines by the FAO Secretariat; a thorough and exhaustive review of the concepts that have been used to define fishery subsidies; a review of the published assessment of the public sector subsidies to the fishery sector and their impact on trade of fish and fish products and fishery resource sustainability; and a review of methodologies used to assess the trade-distorting impact of subsidies to the fishery sector.

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